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ELECTRICAL REVIEW

20 JUNE 1958 PRICE 1s 6d

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'ENGLISH ELECTRIC'

h.r.c. fuse links

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2.

Fusegear Division, East Lancashire Road, Liverpool 10

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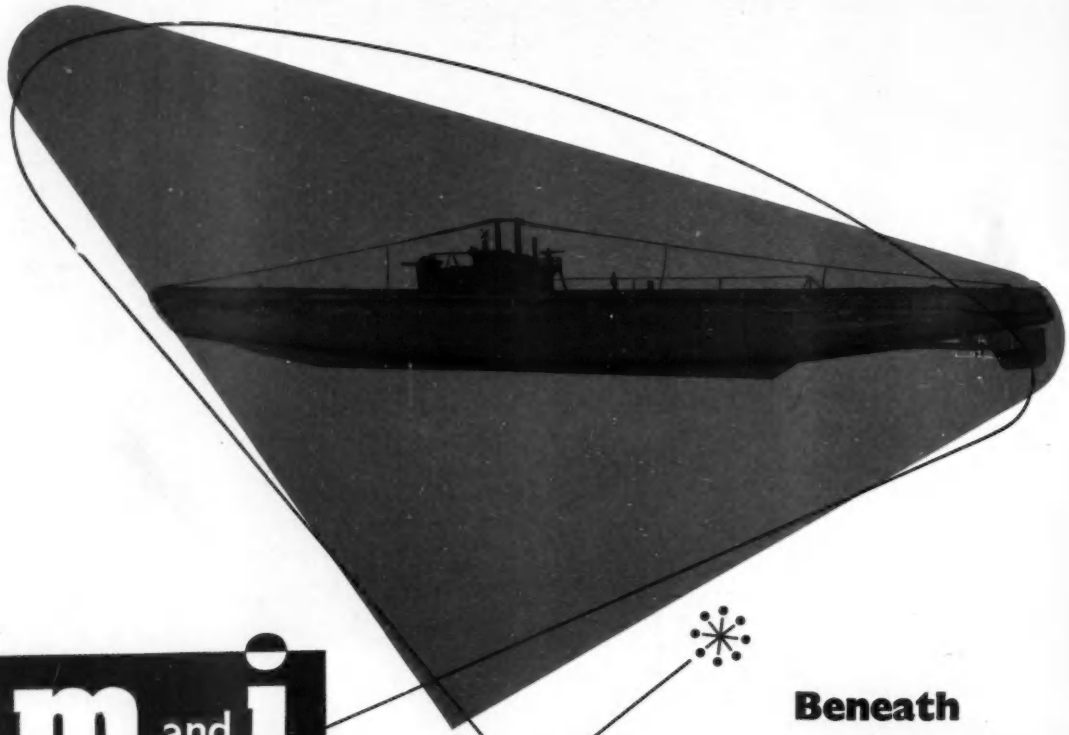
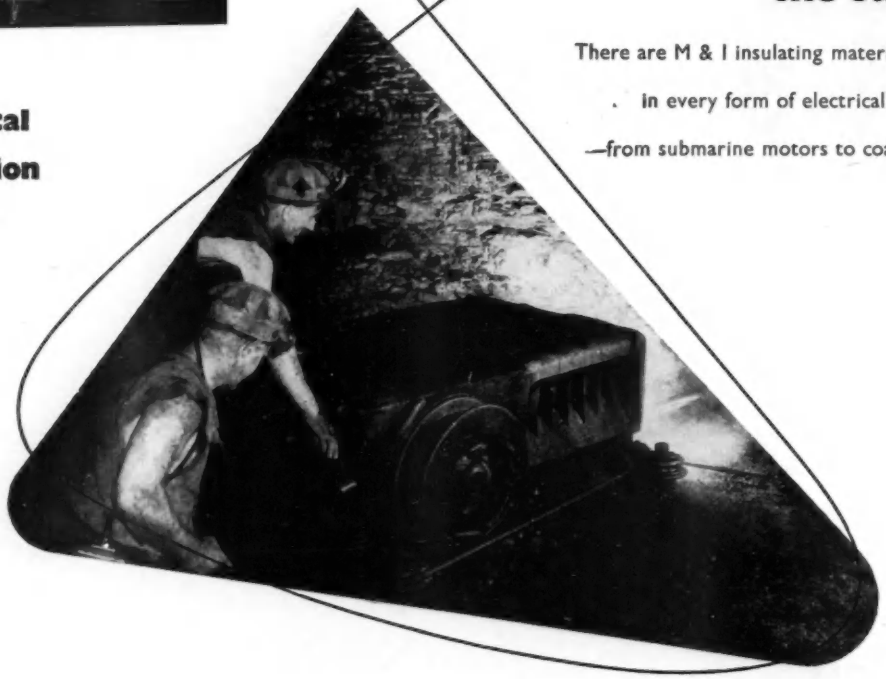


m and i

the electrical insulation people

Beneath the surface

There are M & I insulating materials in every form of electrical equipment —from submarine motors to coal cutters.



TOP PHOTOGRAPH by courtesy of The Admiralty and Vickers-Armstrongs Ltd.
LOWER PHOTOGRAPH by courtesy of The National Coal Board.

THE MICANITE & INSULATORS CO., LTD., WALTHAMSTOW, LONDON, E.17.
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The same twelve months guarantee as all Brook products, plus world wide availability of spares and technical assistance.

IS THE PRICE RIGHT?

The "Merlin" has been designed to meet today's competitive conditions; it is made by modern methods in Brook Motors' newest and most efficient factory.

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Get more information about it; you will find that the price is right too!

the first name you think of . . . for electric motors
from 1/25th. to 600 h.p.

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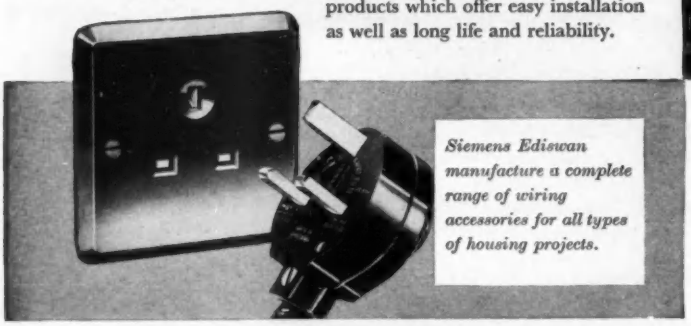
Exacting tests...

Rigorous testing by the London County Council ensures that only the finest materials and fittings are used in their building programmes. Estates such as Britwell (Farnham Royal), Abbey Wood, and Roehampton are all extensively fitted with Siemens Ediswan wiring accessories, which have been approved on the basis of these exacting tests. Esteem of this practical nature has been gained only by design and manufacture to the highest standards, resulting in products which offer easy installation as well as long life and reliability.



Siemens Ediswan manufacture a complete range of wiring accessories for all types of housing projects.

Part of the L.C.C. estate at Britwell, Farnham Royal.

ARCHITECT: Hubert Bennett, Esq., F.R.I.B.A.

ENGINEERING SERVICES: Joseph Rawlinson, Esq., C.B.E., M.Eng., M.I.C.E., M.I. Mech.E., Chief Engineer to the L.C.C.

BUILDERS: Holland & Hannen and Cubitts Ltd., 1 Queen Anne's Gate, London, S.W.1.

ELECTRICAL CONTRACTORS: F. E. Morris Ltd., Mina Avenue, Langley, Slough. (Part). Holliday & Son (Electrical) Ltd., Balham High Road, London, S.W.12. (Part).

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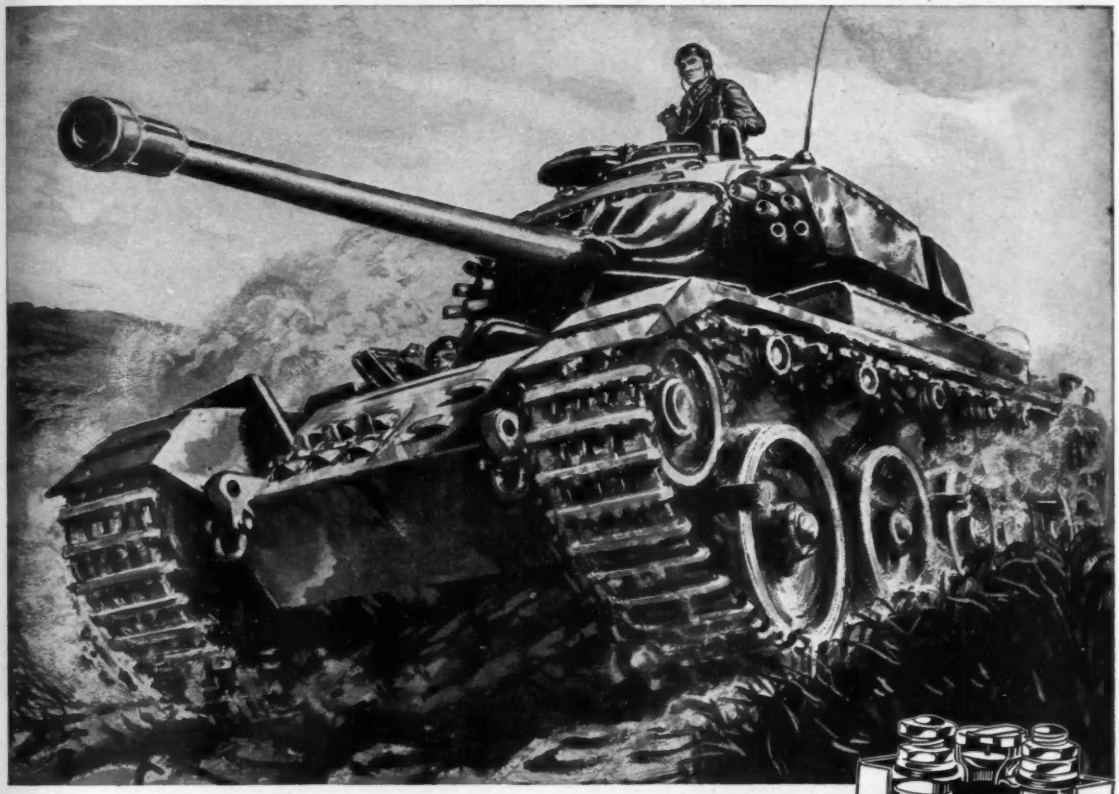
Which battery is built like a Centurion Tank?



Answer—a Nife! It too is made of steel and like the Centurion Tank is built to stand up to the toughest use—to withstand shock and vibration and to operate efficiently under the severest mechanical conditions. In direct contrast to the Centurion Tank, however, a Nife Battery is small and compact, takes up very little space and requires virtually no maintenance. Also a Nife withstands the heaviest discharge, is free from self-discharge and is unaffected by idleness in any state of charge. *It repays its original cost many times over!*

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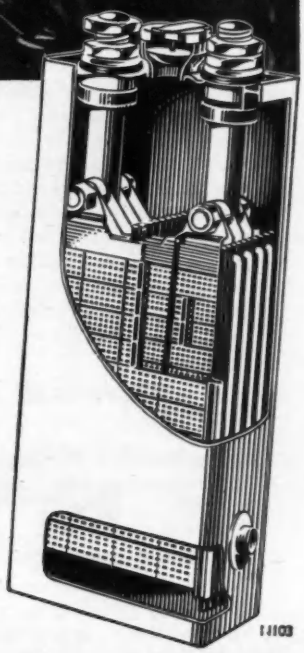

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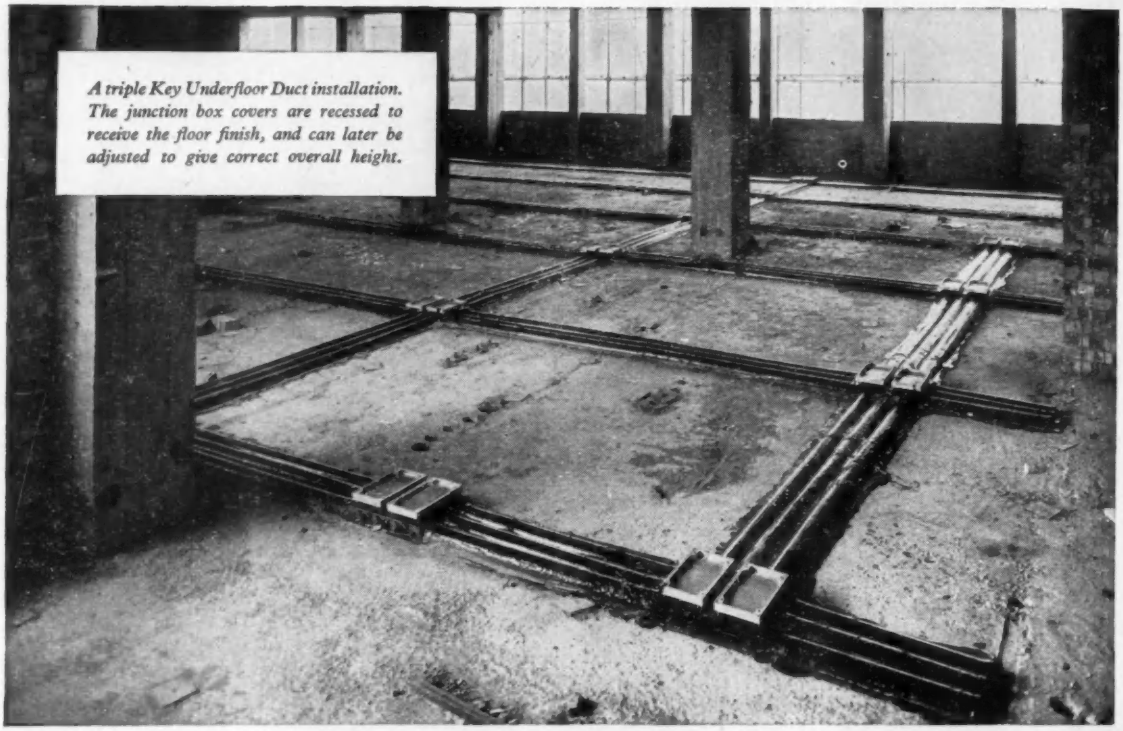
Key Underfloor Duct
solves wiring problems economically



A triple Key Underfloor Duct installation. The junction box covers are recessed to receive the floor finish, and can later be adjusted to give correct overall height.

Electric power and telephone outlets can be installed and added as necessary when Key Fibre Underfloor Duct is used. On a materials plus labour basis the cost of installations is lower than any metal system. Because of their light weight and ease of cutting and fitting, Key ducts can be quickly laid. Since there is no necessity to pre-position outlets, the architect can install an underfloor duct scheme, and later fit outlets to suit the occupant's requirements. The fitting of these outlets is a quick and simple matter and the most complete range of fittings is available for lighting and telephone systems.

easy to lay—low cost
completely adaptable

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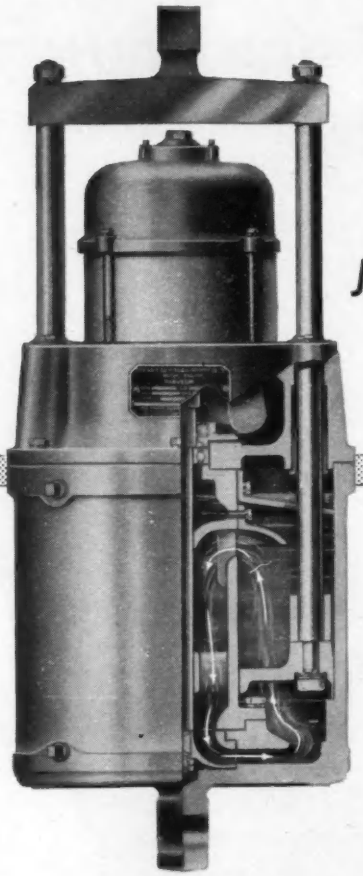

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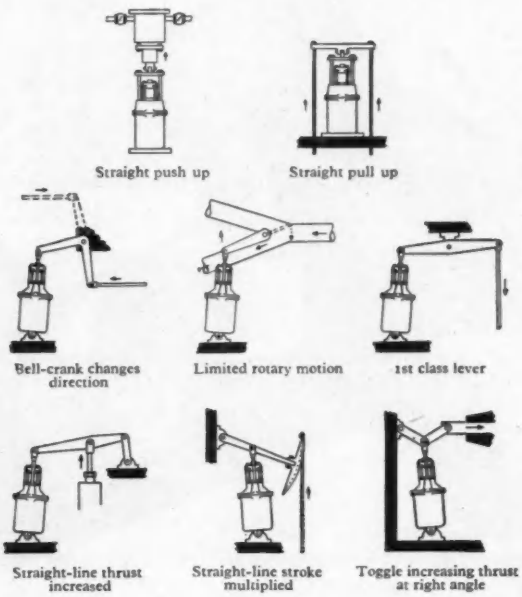

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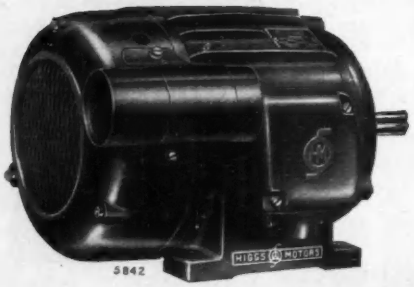

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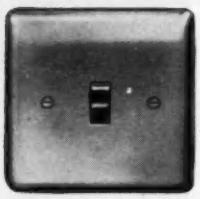

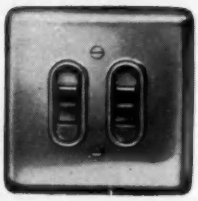

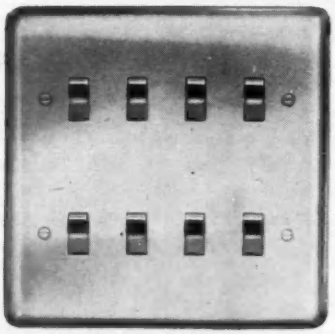

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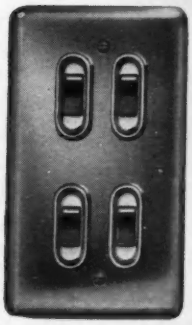

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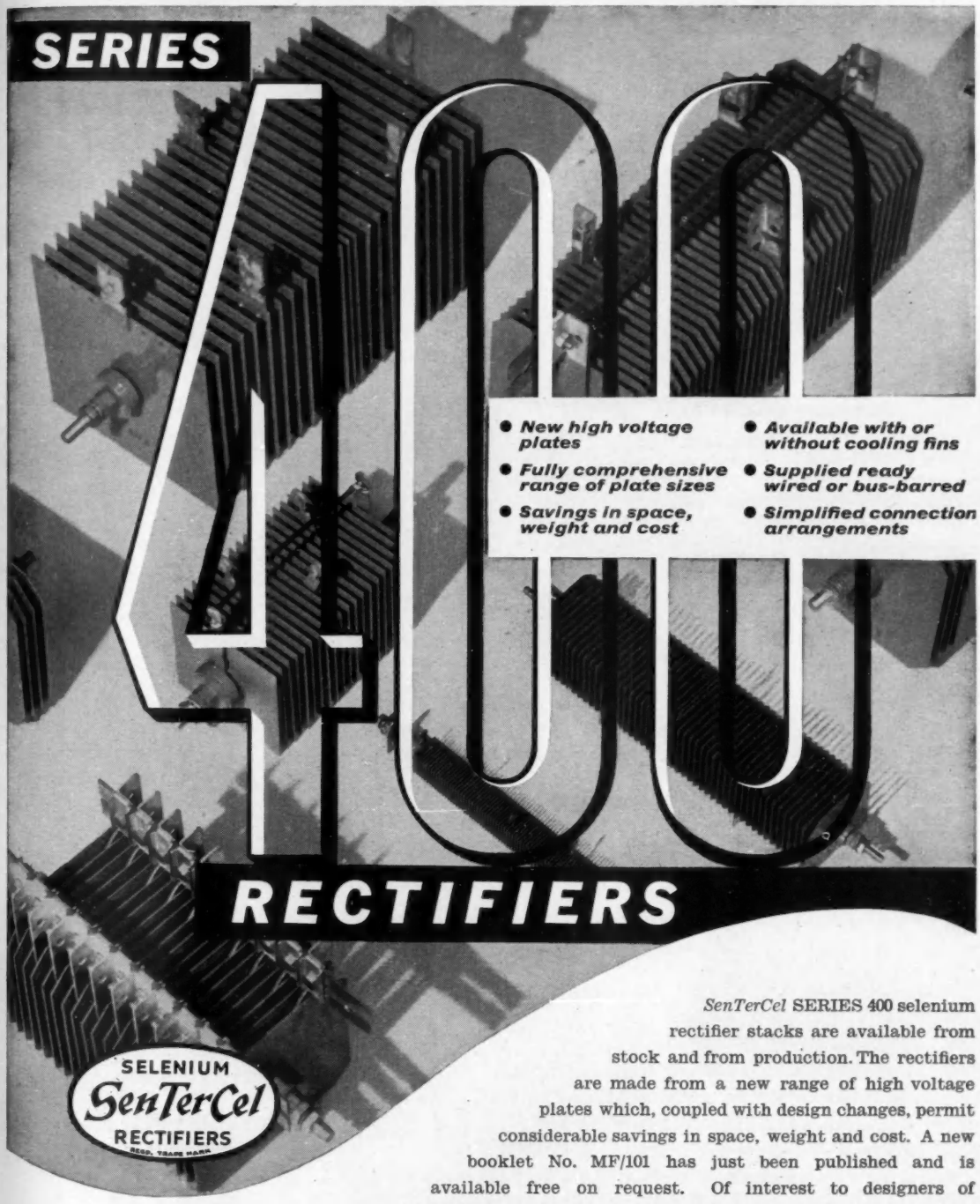

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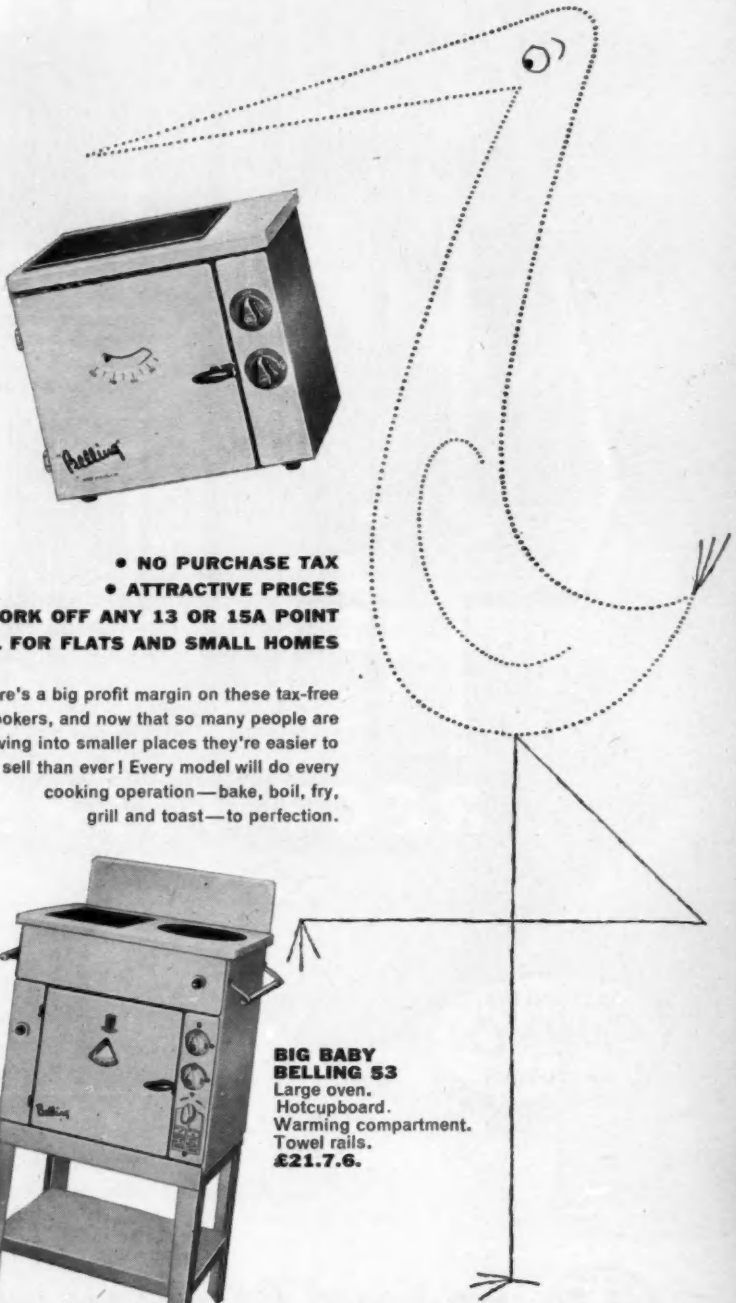

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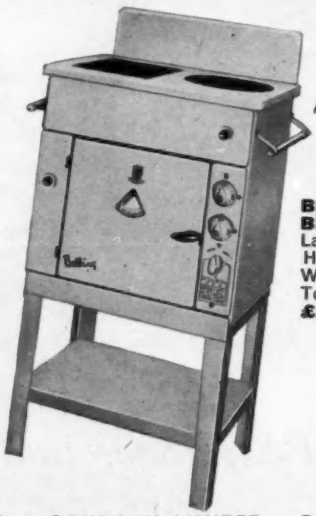

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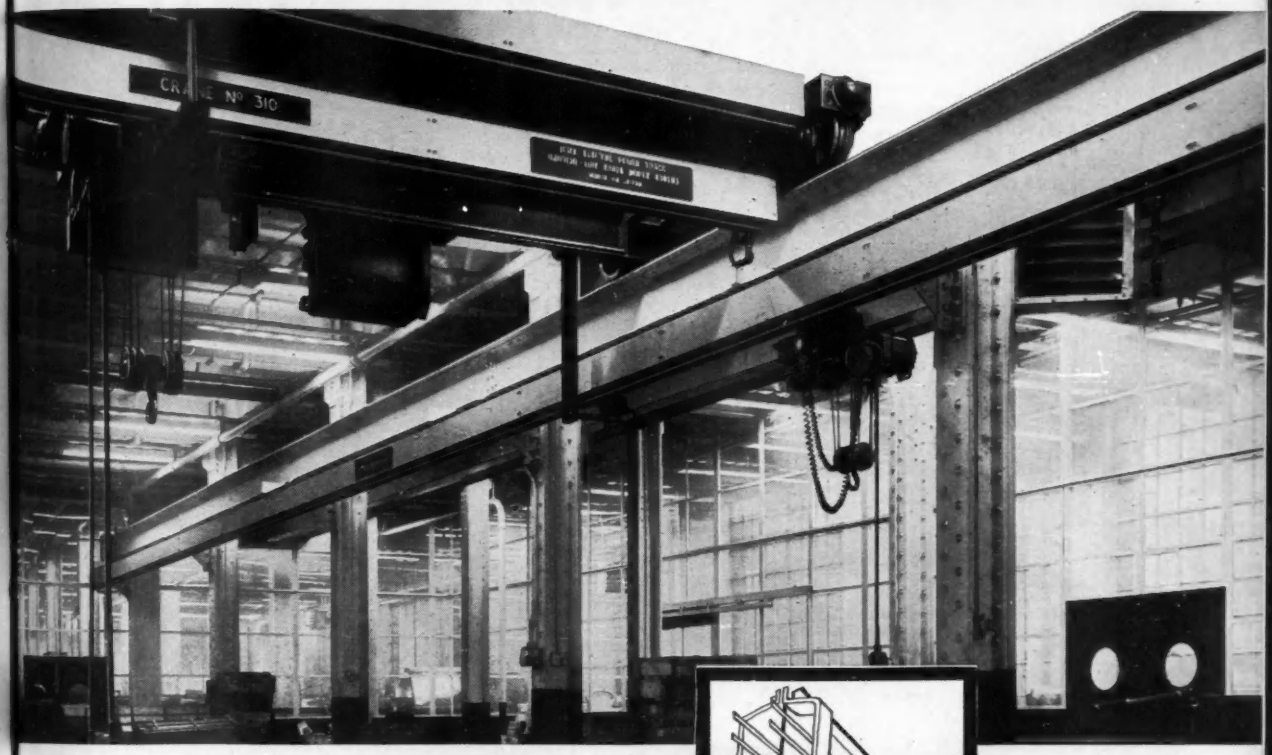

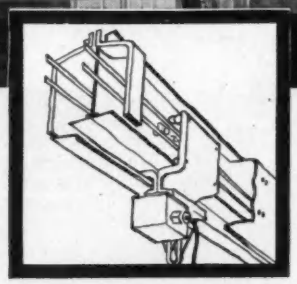

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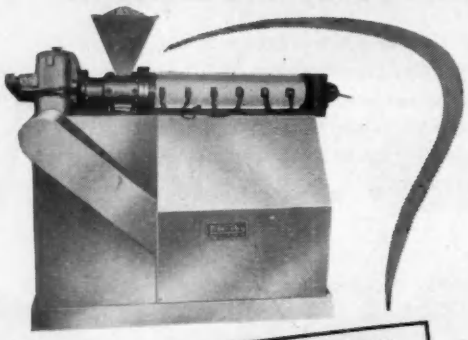

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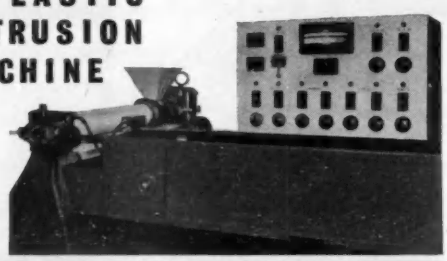

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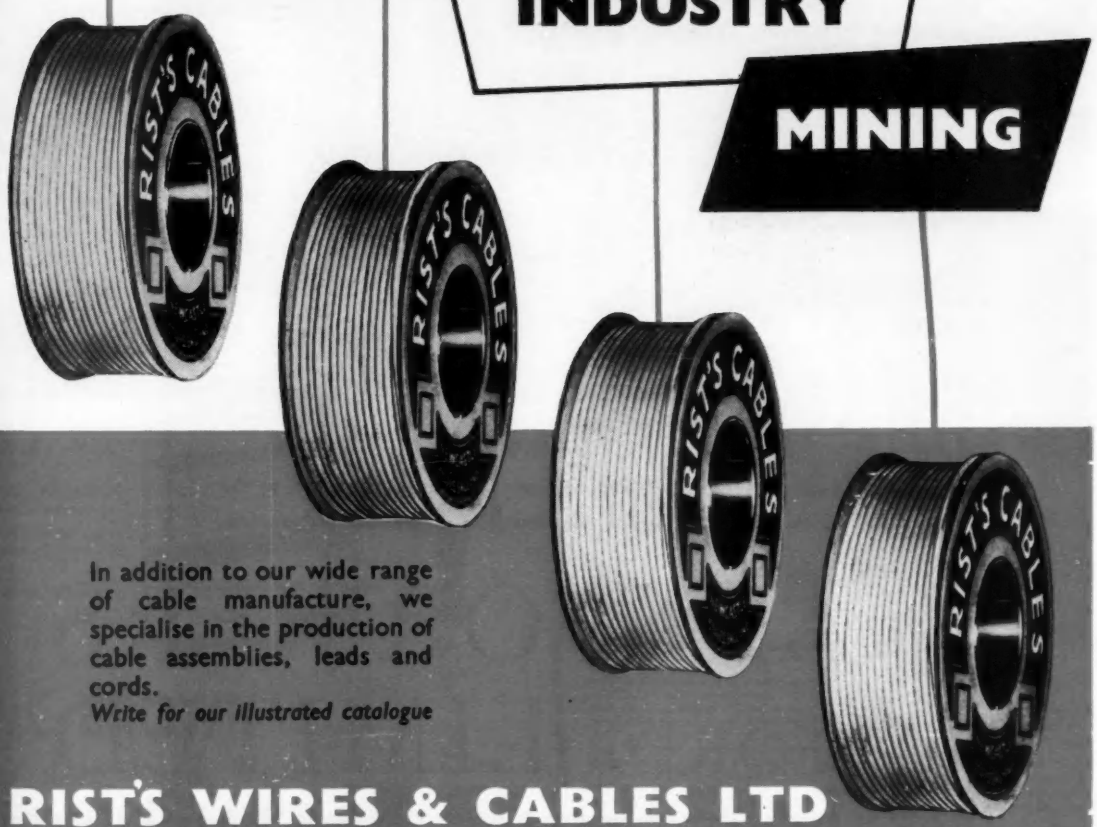

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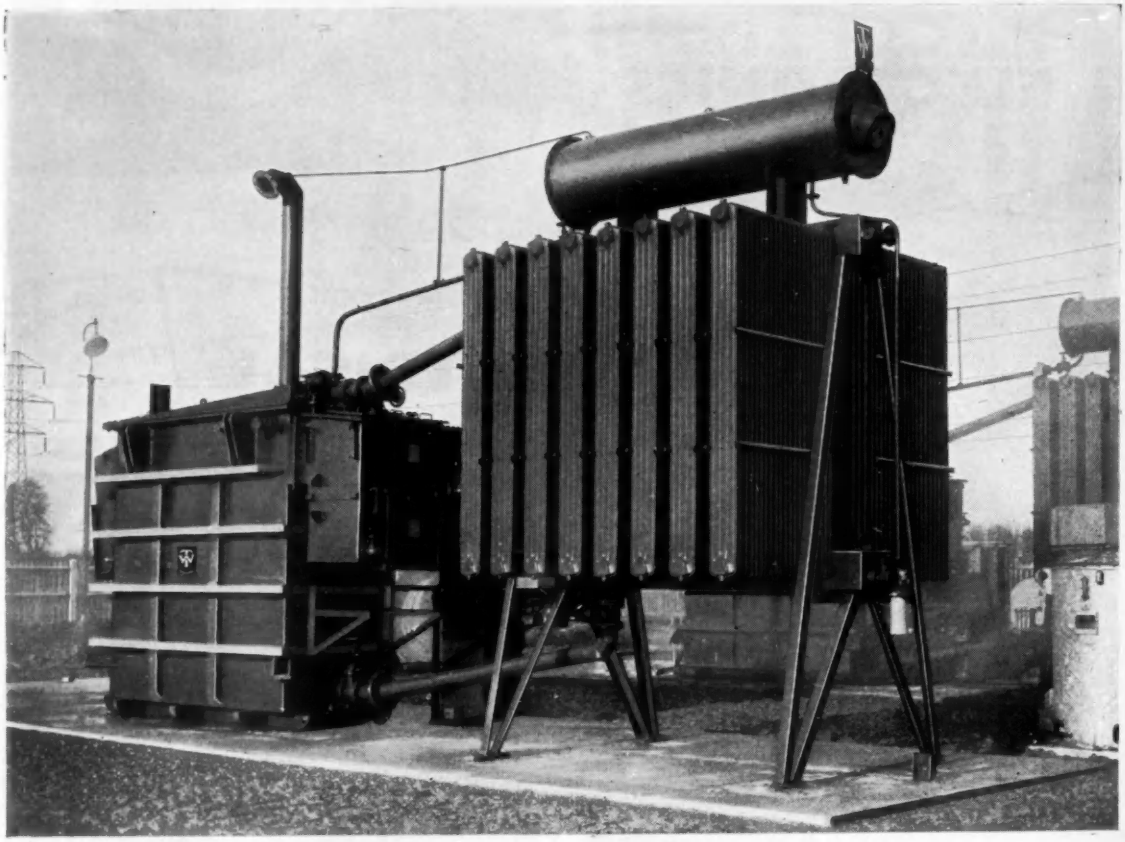

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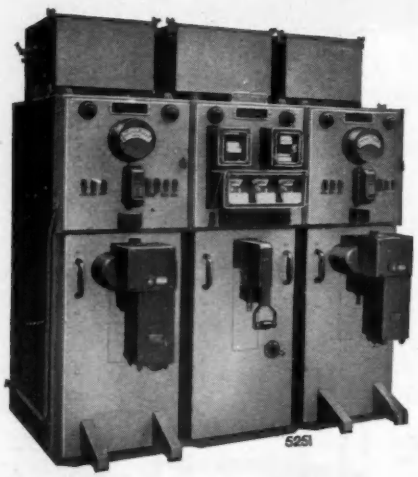
A.S.T.A. CERTIFIED



AIR INSULATED
VERTICAL ISOLATION
HORIZONTAL DRAWOUT

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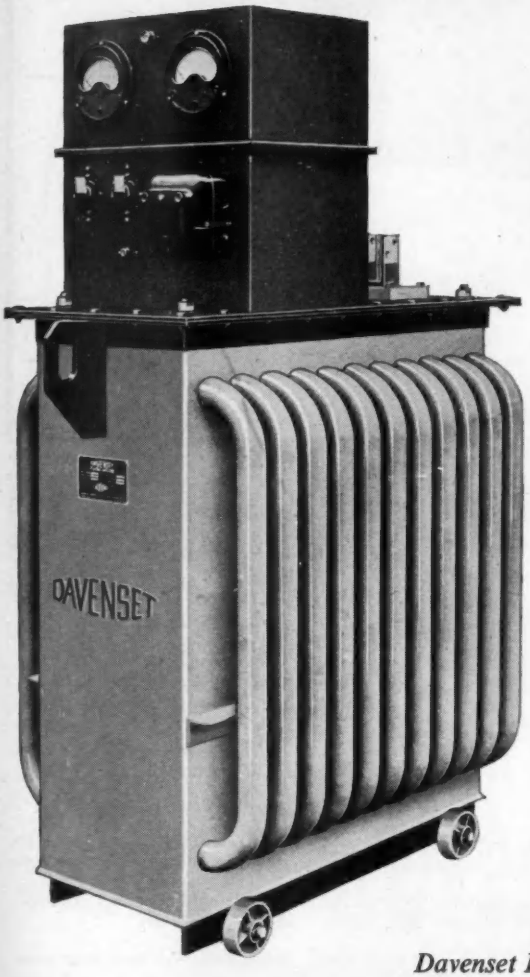
Power for plating



- No maintenance of any type needed.
- No moving parts to break down
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- No rheostats to wear out
- Conservatively rated for continuous duty at full load

- Low in price—high in efficiency
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- Quick delivery

Davenset Plating Rectifiers are being used extensively as individual units or in banks in the U.K. and overseas

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for **CONTINUOUS DUTY AT FULL LOAD**

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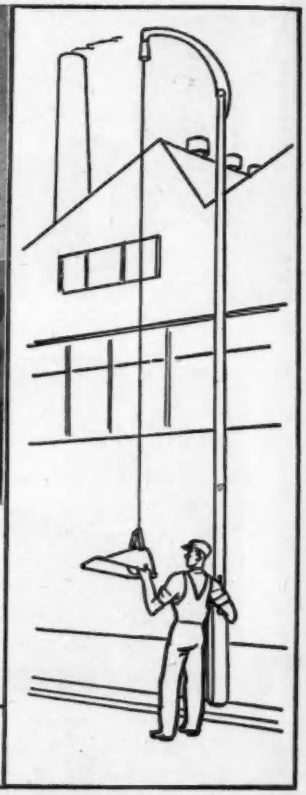

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SUPER WONDER BATTEN

9 STAR FEATURES

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- Fully compounded and cased
- 5 ft. 80 watt and 4 ft. 40 watt chokes are tapped for 200/250 volts supply
- Entirely new design
- All sizes individually packed and the 5 ft. 80 watt in a strong fibreboard carton
- Constructed from rustproof steel and stove enamelled white
- Simple clip-on rigid lamp holder covers
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PRICES DO NOT INCLUDE LAMP

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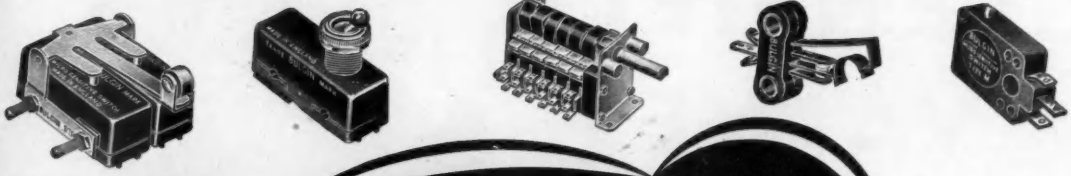
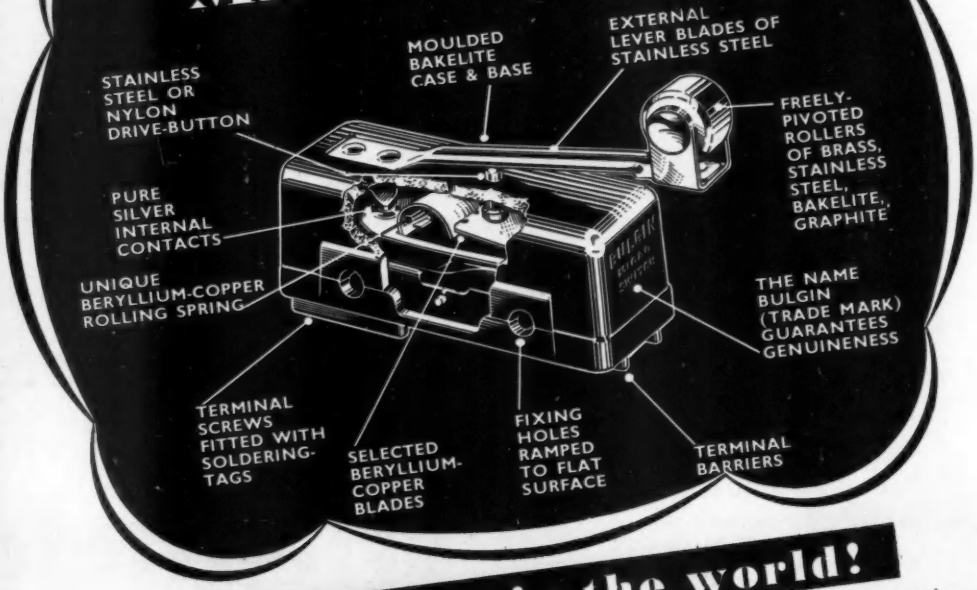


BULGIN
Micro-Switches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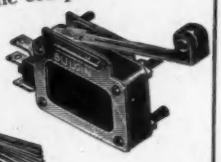

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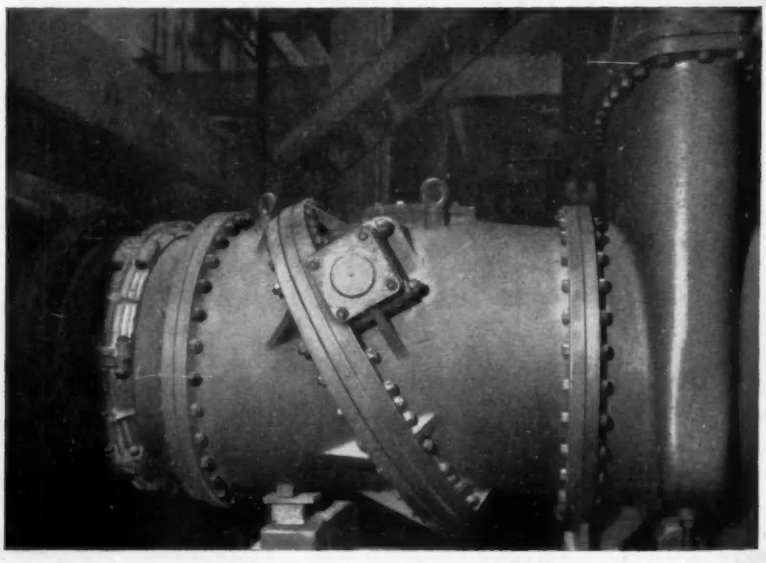

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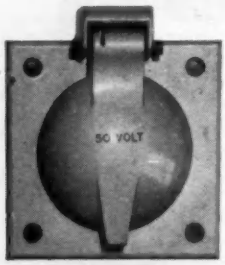

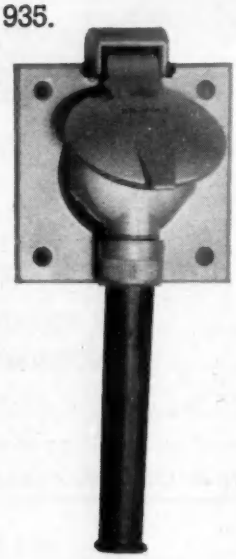

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The 110-volt, 50-volt, and 25-volt plugs cannot be inserted into any other socket than that for which each is intended. The voltage indication on both plug and socket is an optional extra.

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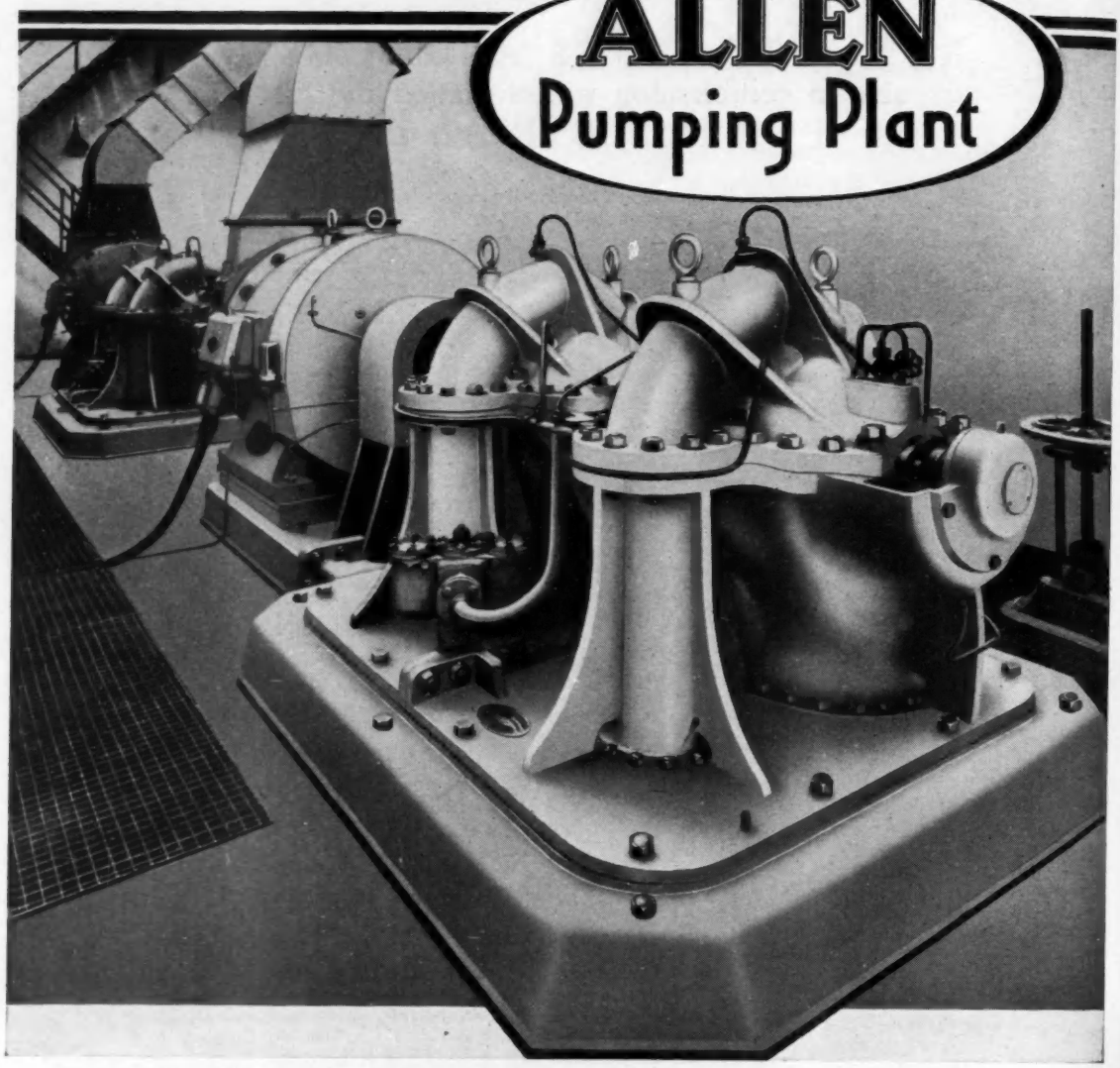

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The largest power station in SOUTH AFRICA

The installation comprises two Allen horizontal double-suction, two-stage pumping sets with a total capacity of 800,000 gallons per hour against a head of 475 feet, running at a speed of 1,485 r.p.m. The pumps are driven by 1,245-h.p. Metro-Vick motors and deliver water from the Vaal River to the power station for condenser cooling purposes.

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Up to 75kW for industrial and laboratory use

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The curves indicate:

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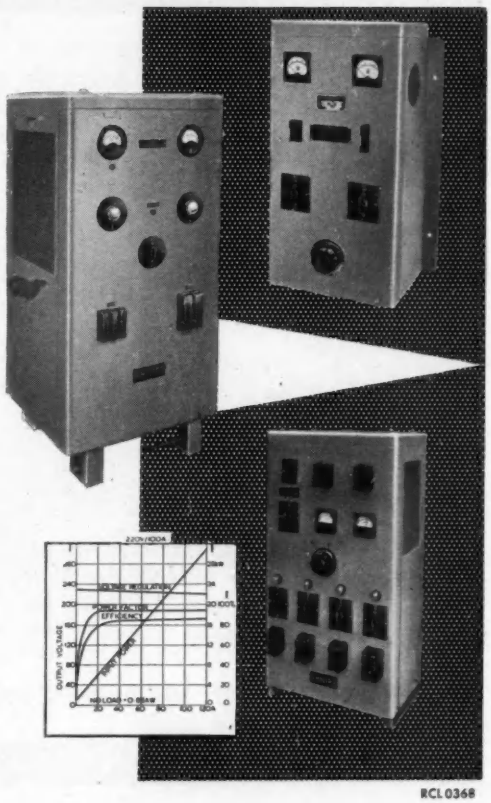
Rectifiers can be constructed to individual requirements or to fit into existing site conditions. If you would like our technicians to visit your premises and advise you without obligation, or if you require further details of our range of rectifiers, please write to address below.



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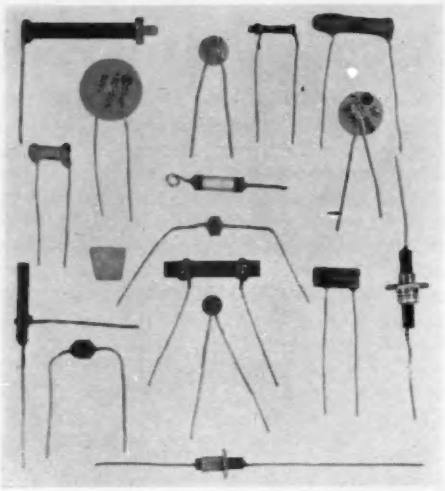

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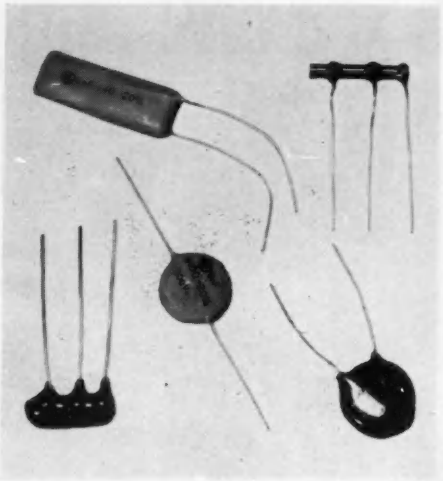

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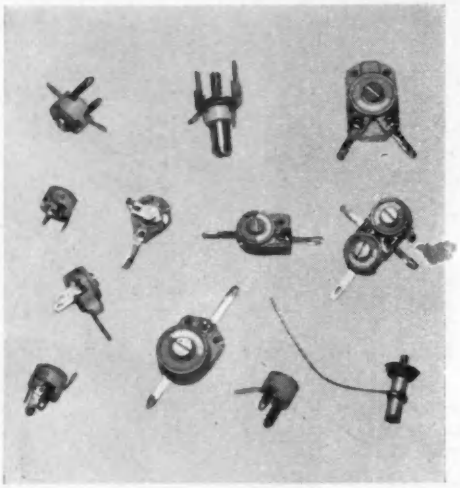

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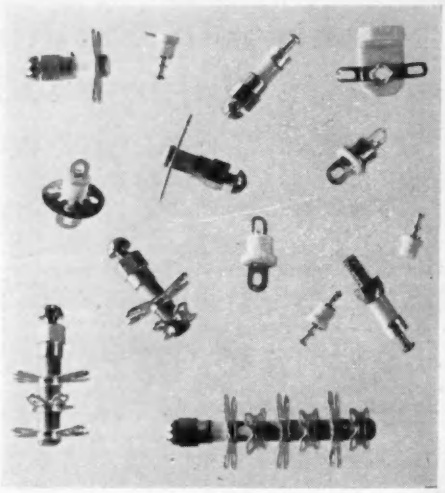

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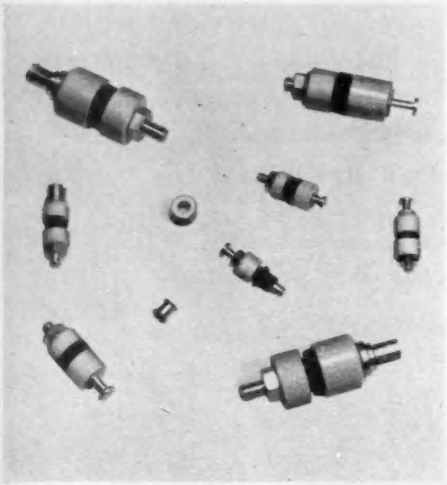

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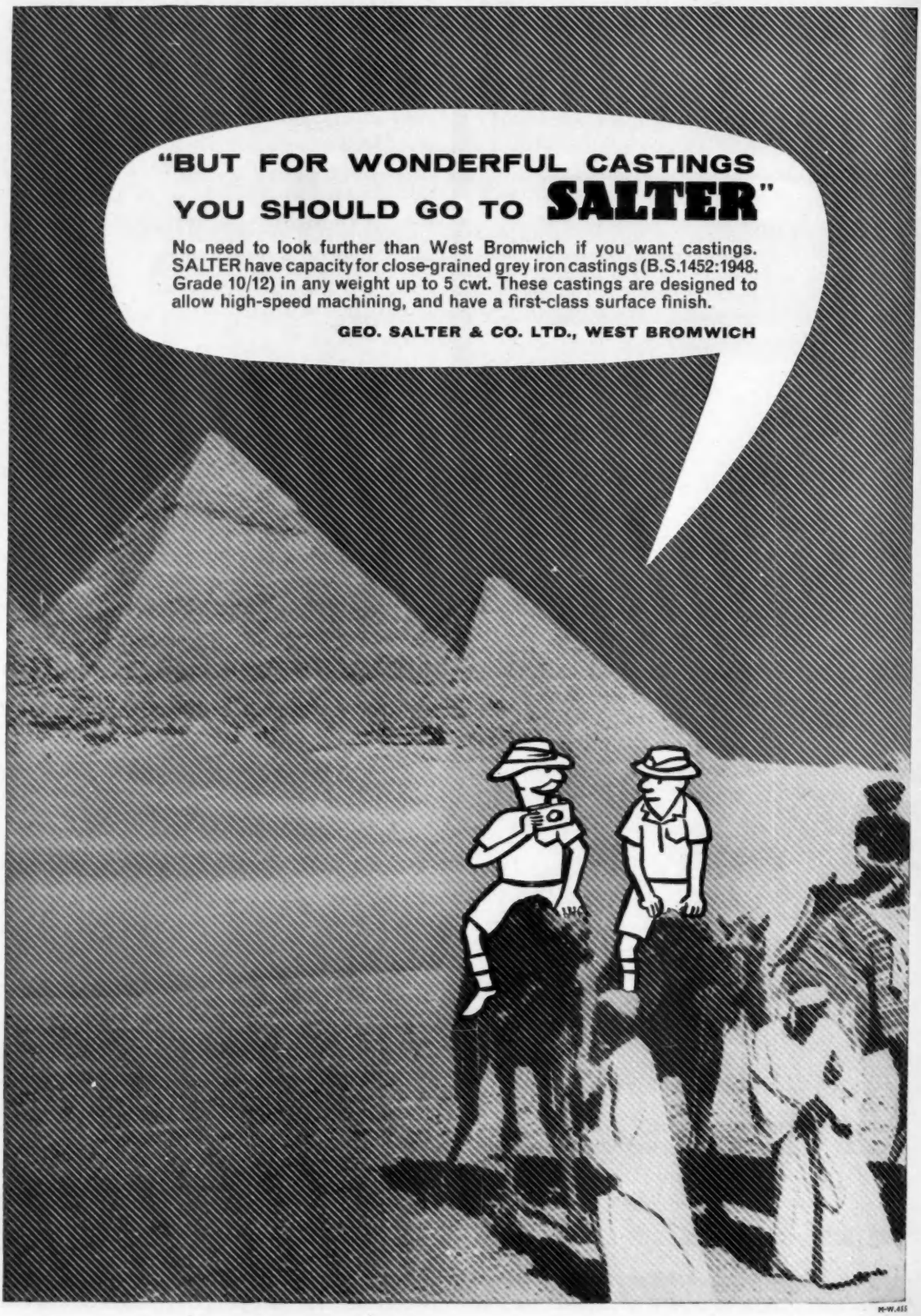
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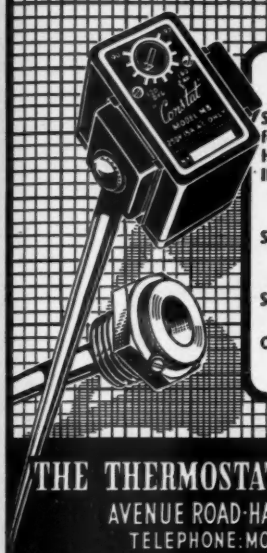

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STEM TYPE THERMOSTAT for control of IMMERSION HEATERS, PLATENS, DRYING OVENS, Etc.
Suitable for 15 amps, 250 V. A.C. only.

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Rectangular Flush 5" x 4" approx.

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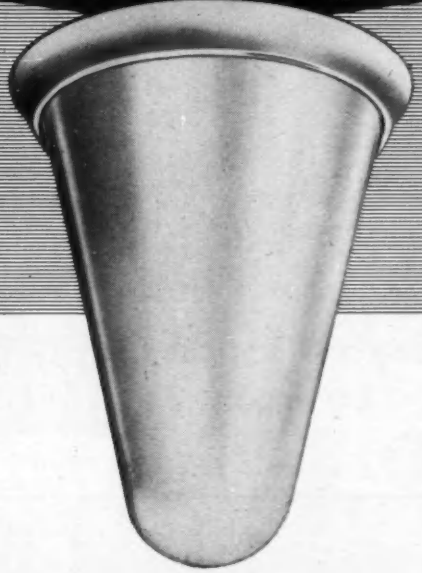
'CLIPTITE'
CEILING FITTINGS



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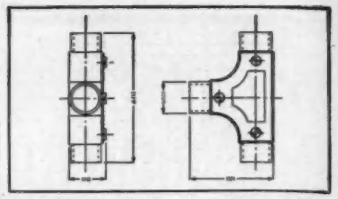

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they're made to last . . . METALLIC **CONDUIT TUBES & FITTINGS**

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THE METALLIC SEAMLESS TUBE CO. LTD., LUDGATE HILL, BIRMINGHAM 3
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MACHINED & FABRICATED PARTS IN INSULATION.

Paxtons

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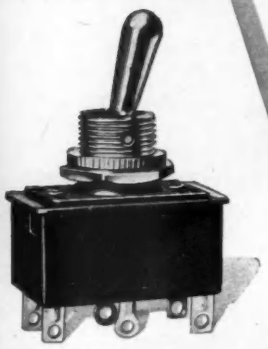
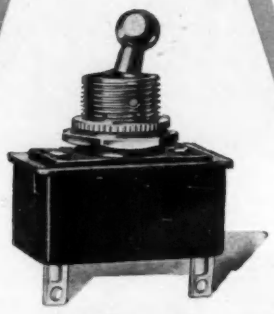
Switches

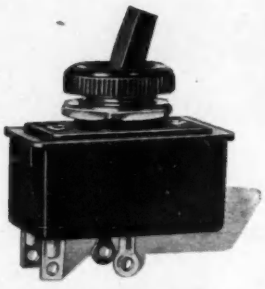
For Instrument and Electronic Applications



* Cat. No. 81058-BT. Double Pole Double Throw. 2 Position Lever Type. Back Connecting Lugs.



Cat. No. 81046. Single Pole Single Throw. 2 Position Lever Type. Back Connecting Lugs.



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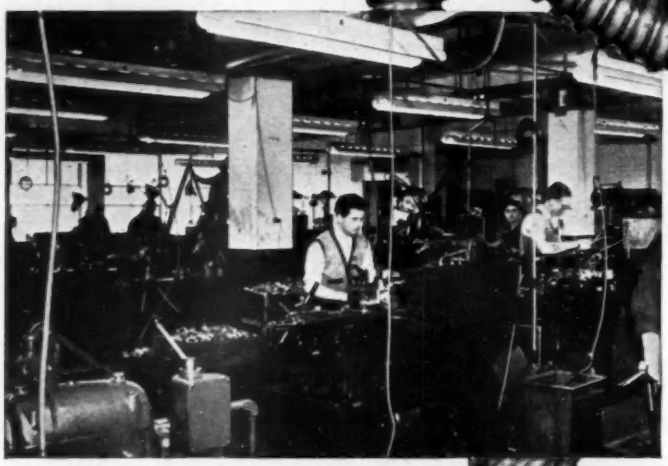
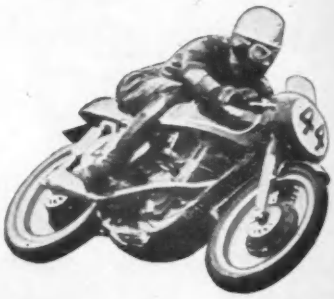


Henley "M.F.A." cables serving bush-grooving machines at the Woolwich factory of Associated Motor Cycles Ltd.
Electrical Contractors: Messrs. Troughton & Young.



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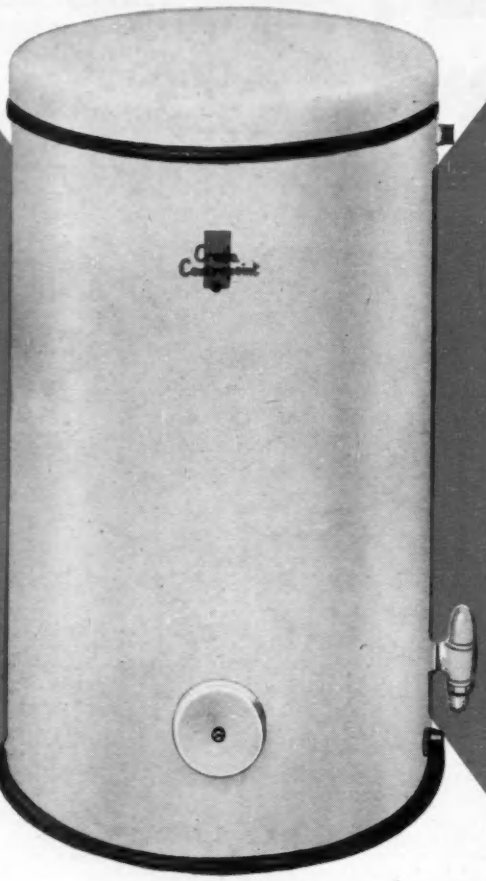

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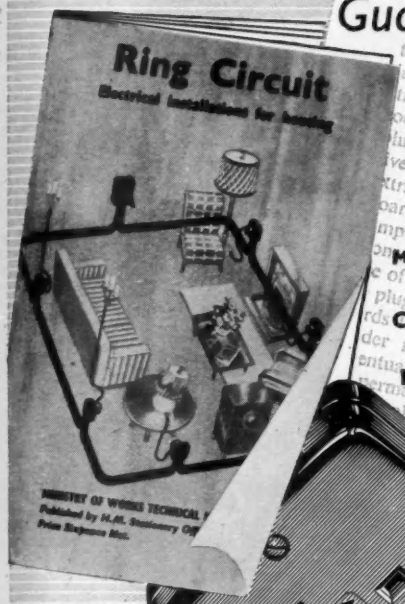

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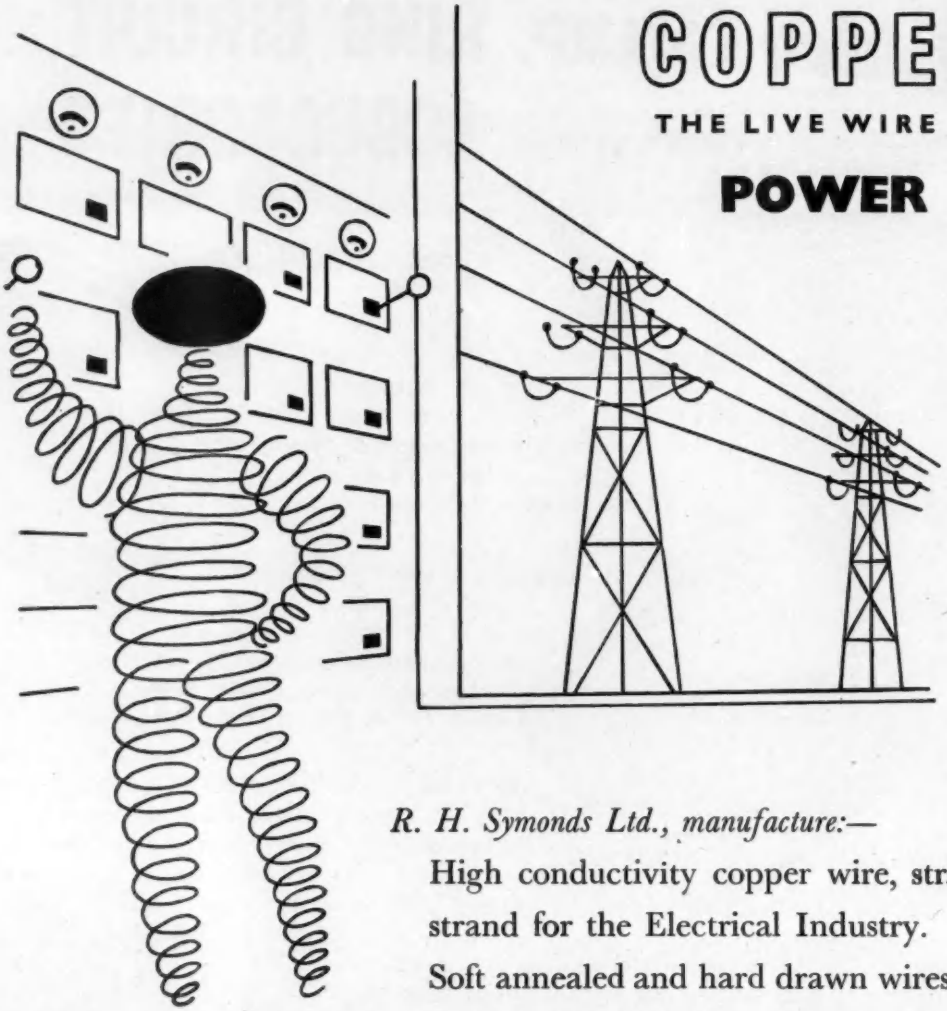

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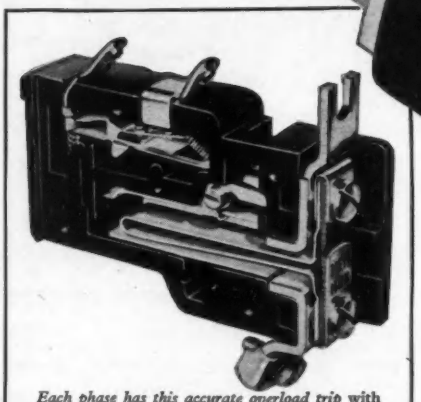

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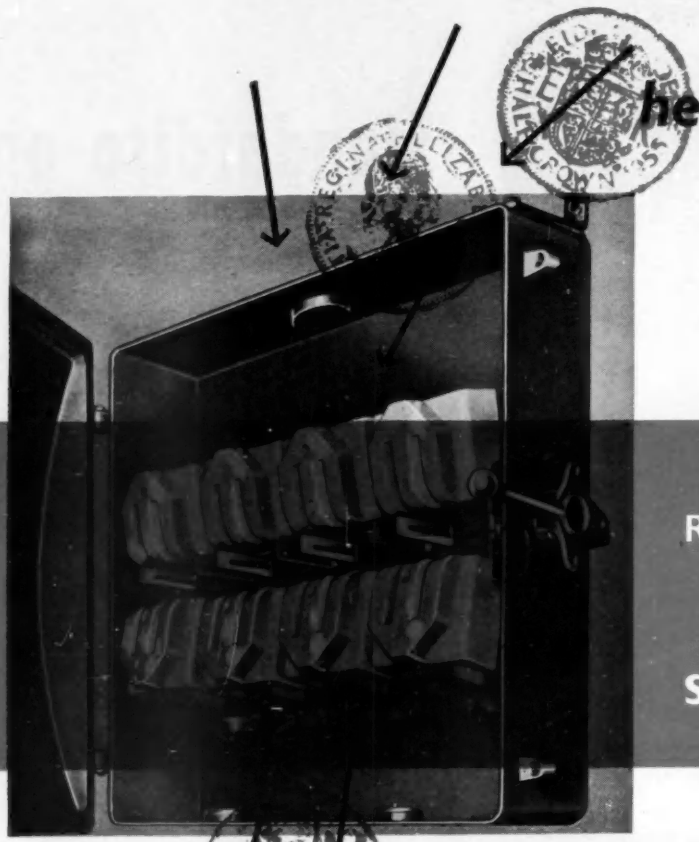

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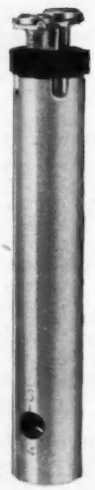

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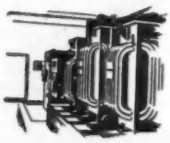

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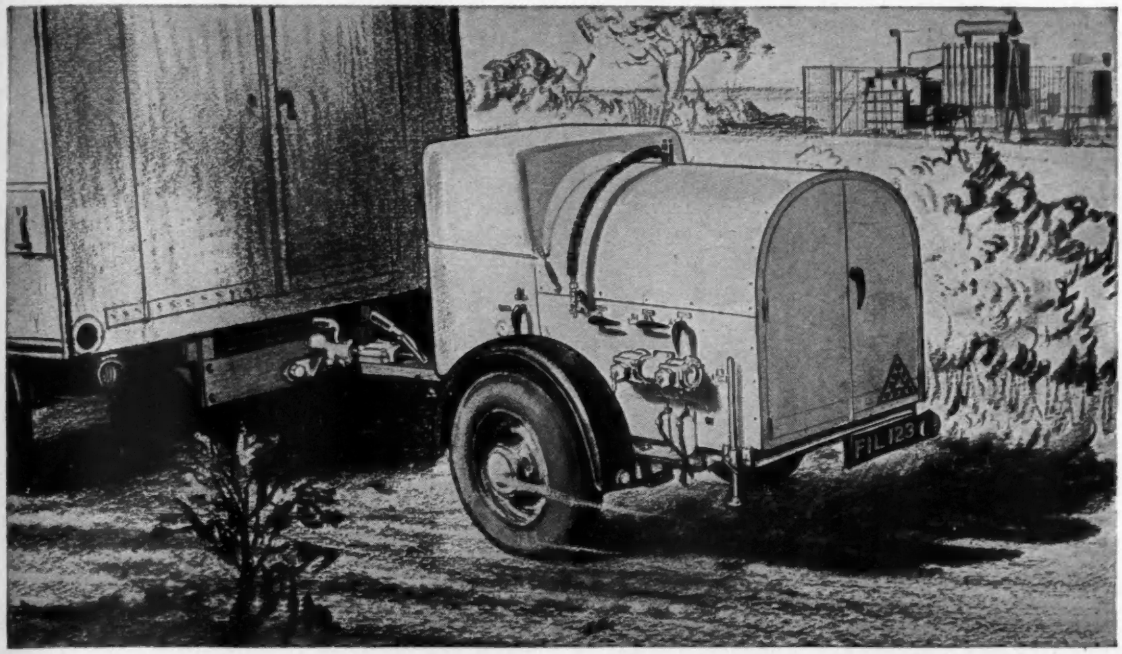

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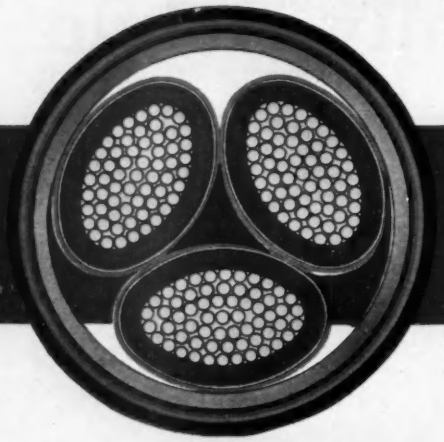

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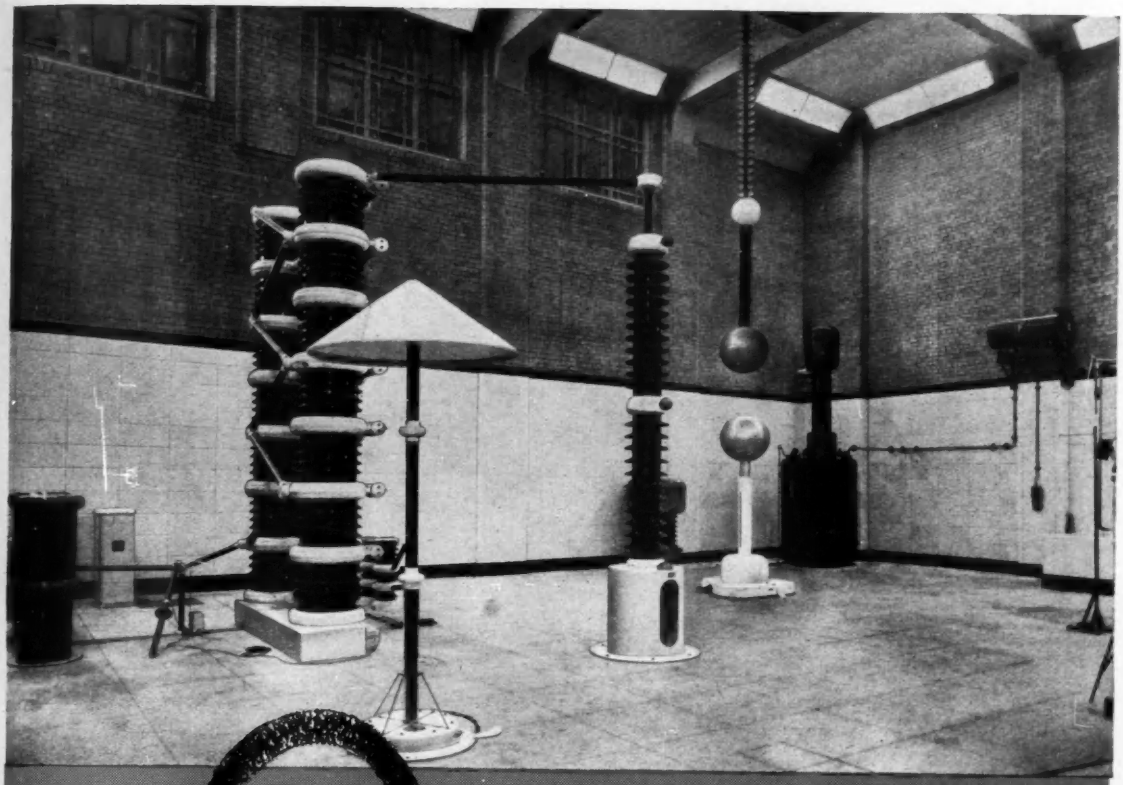

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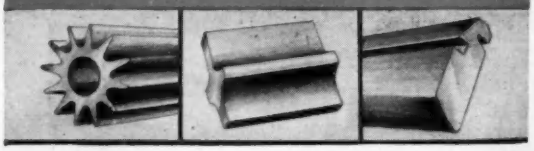

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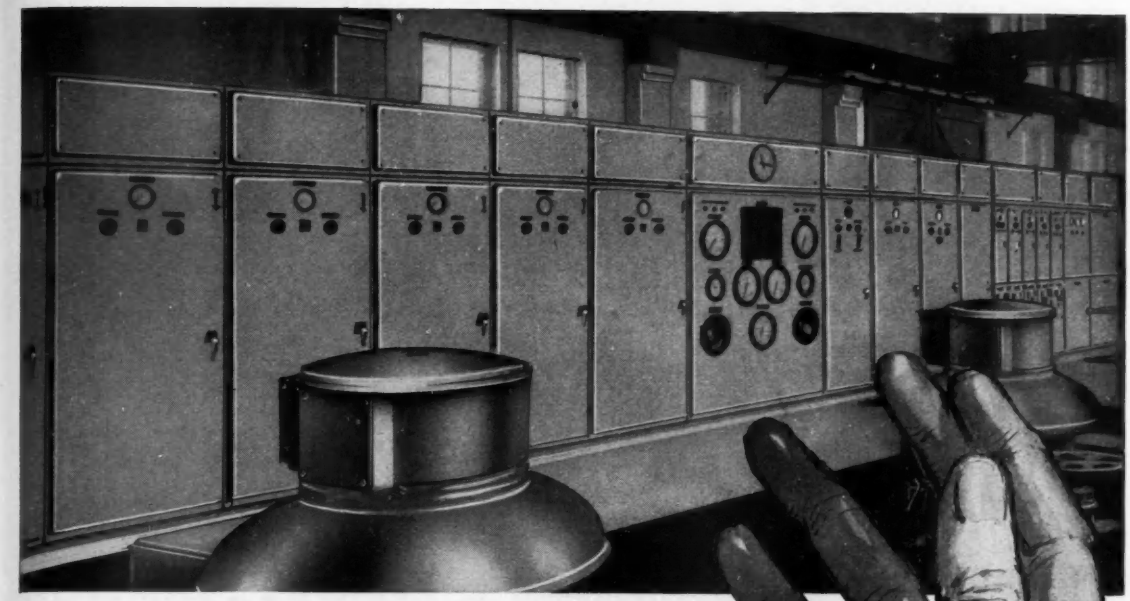

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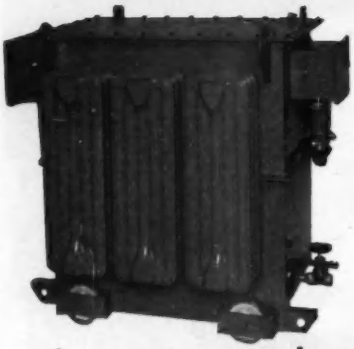

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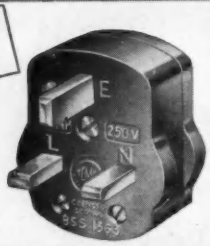

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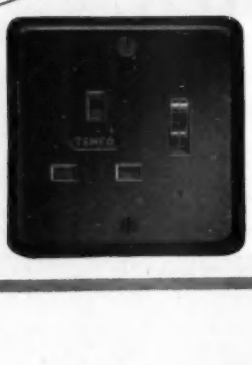

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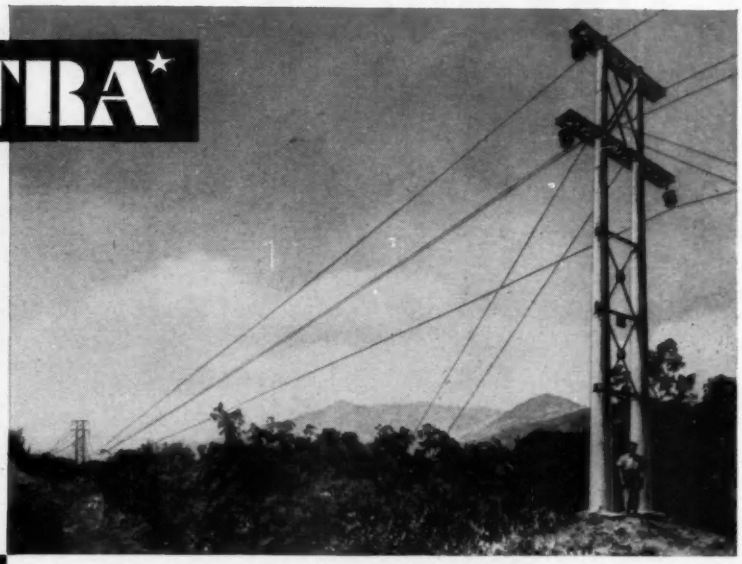

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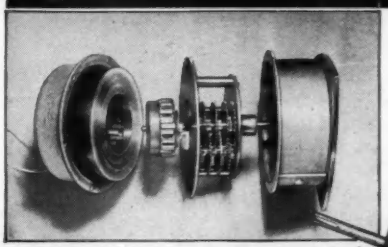

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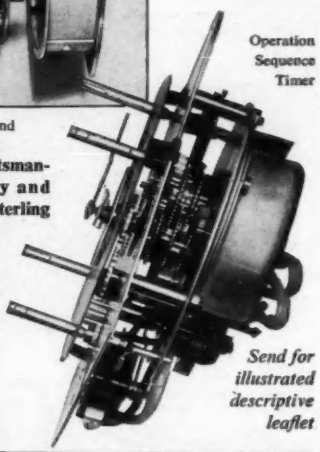

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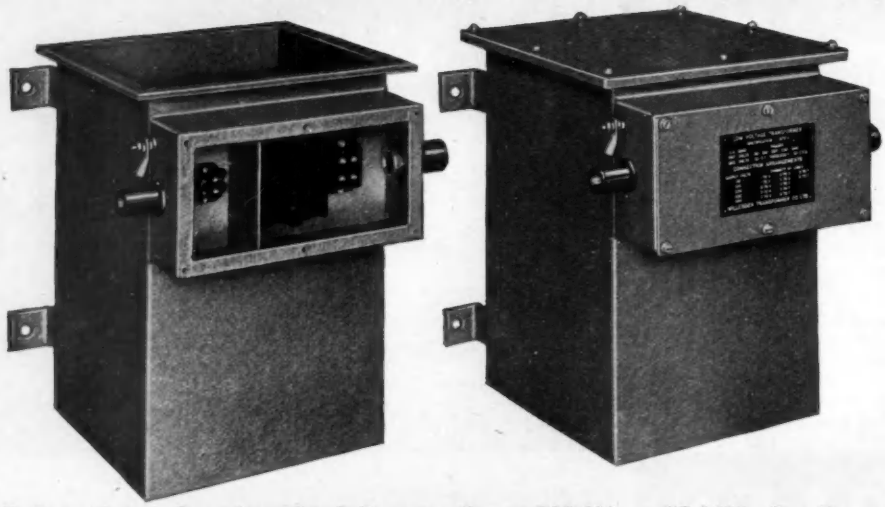

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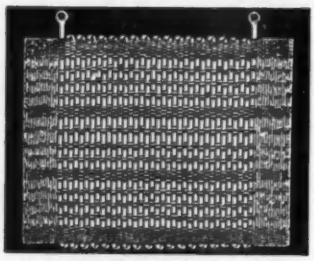

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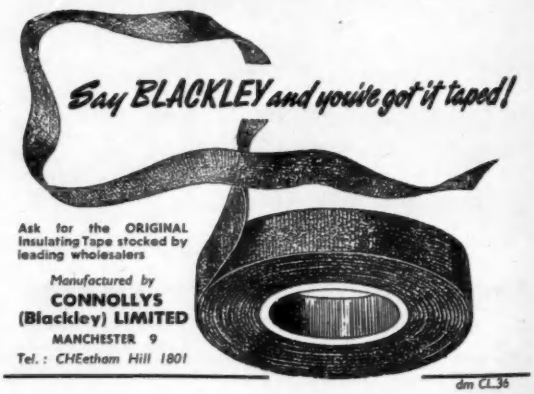

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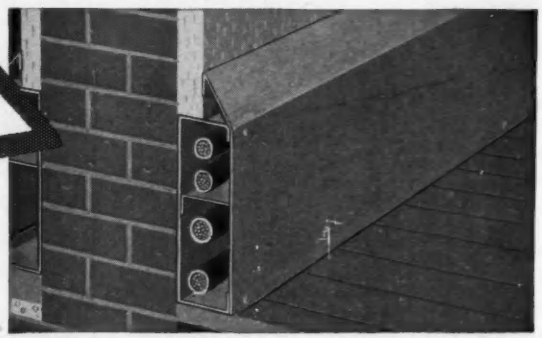

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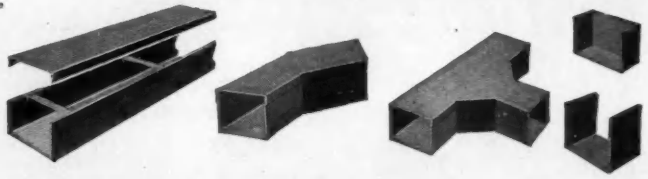

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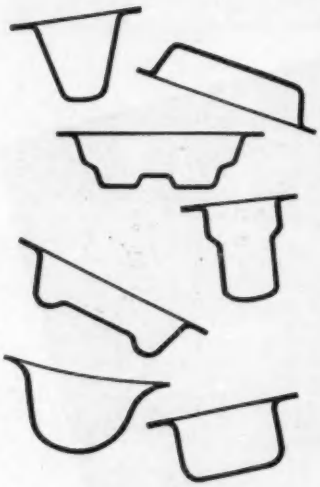

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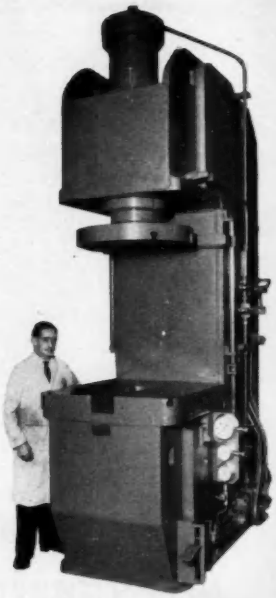

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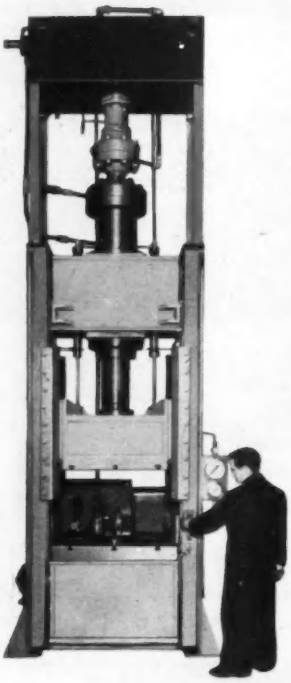

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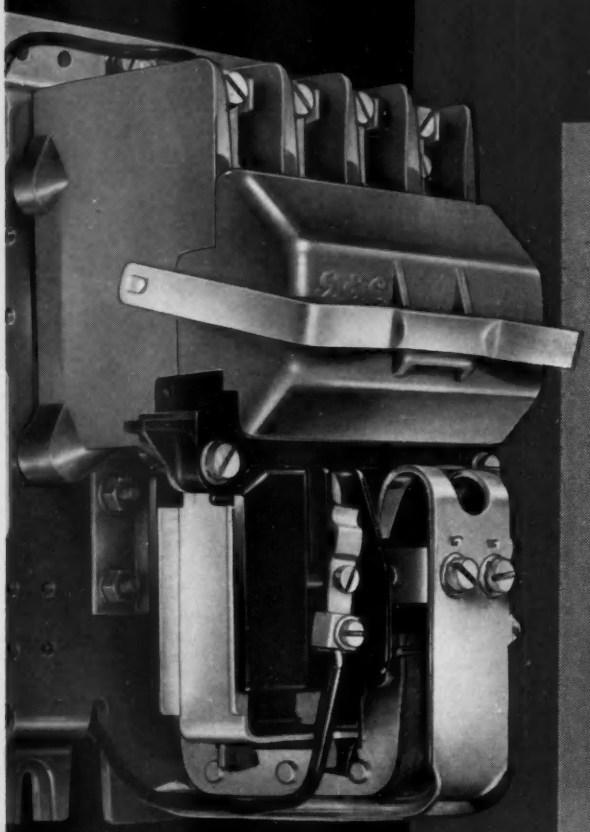

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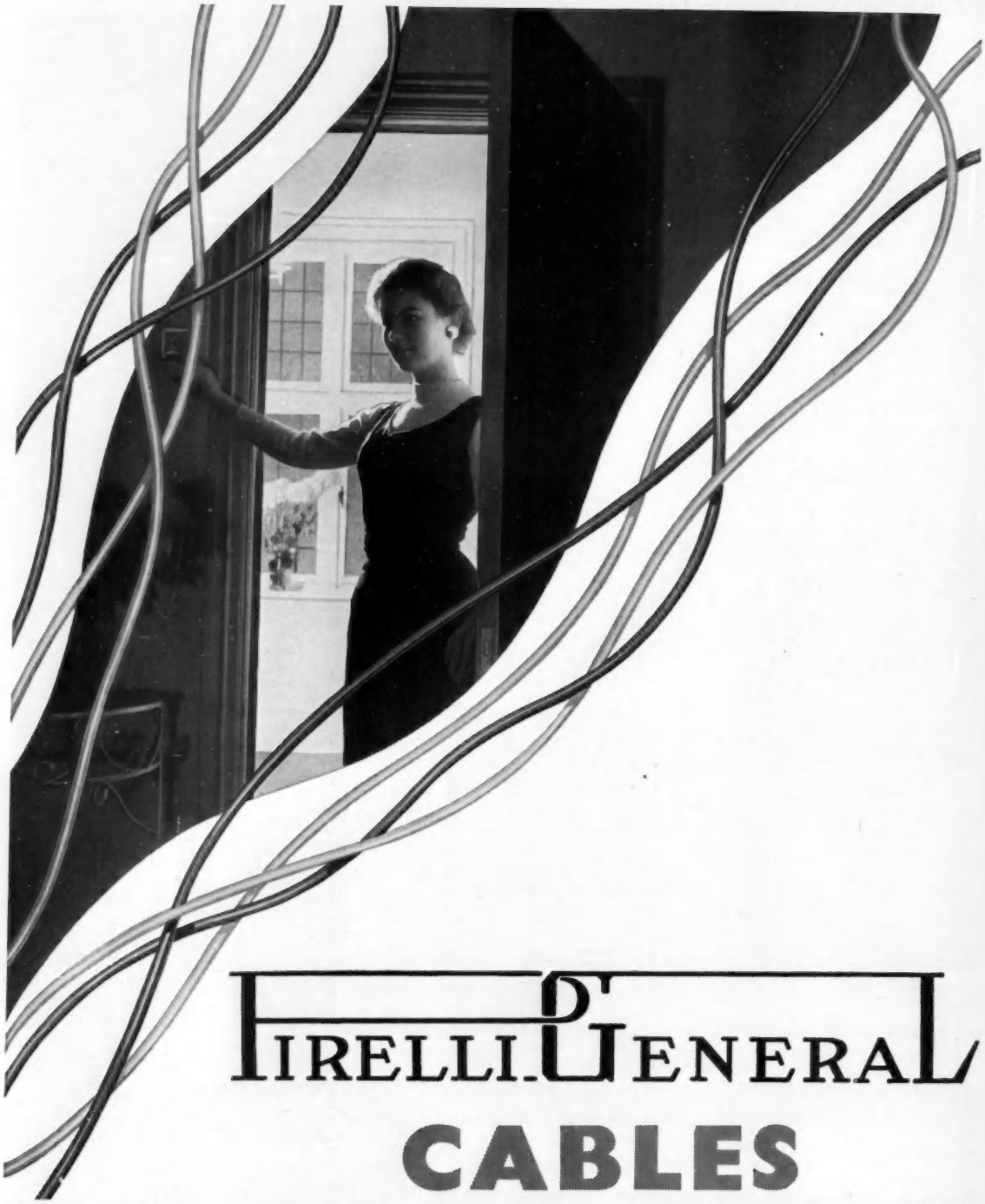

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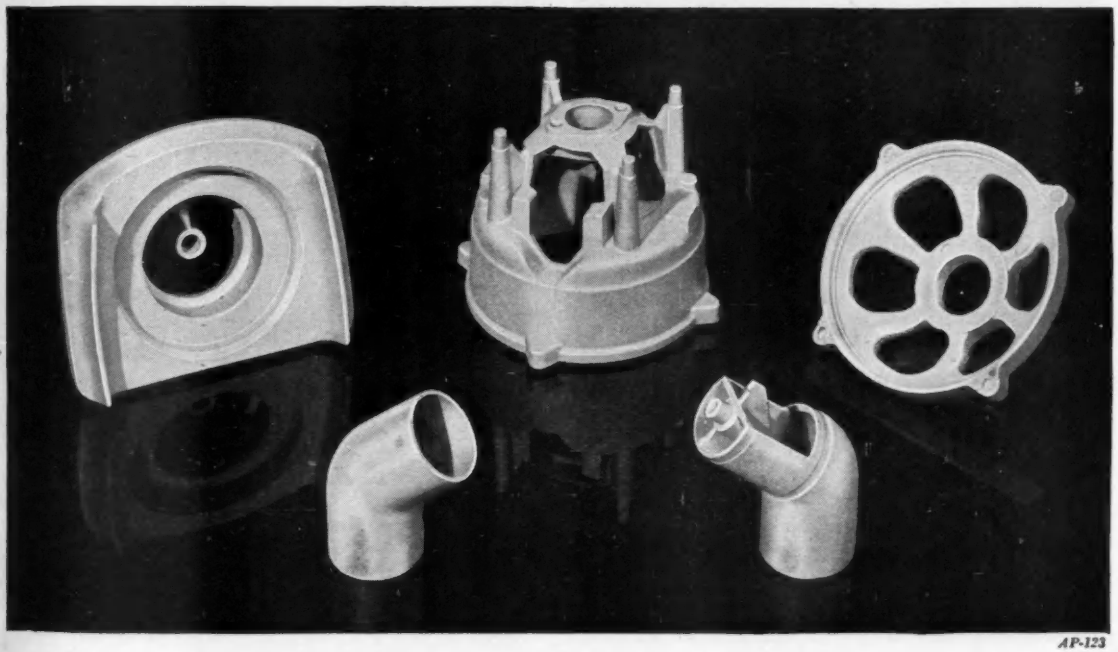

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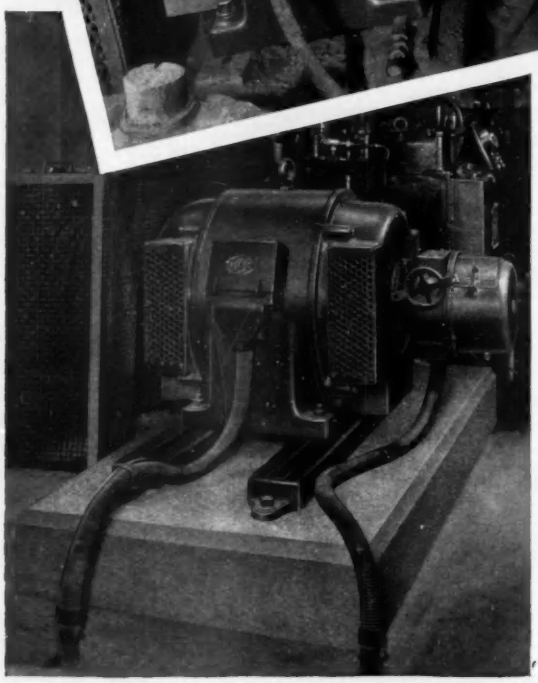
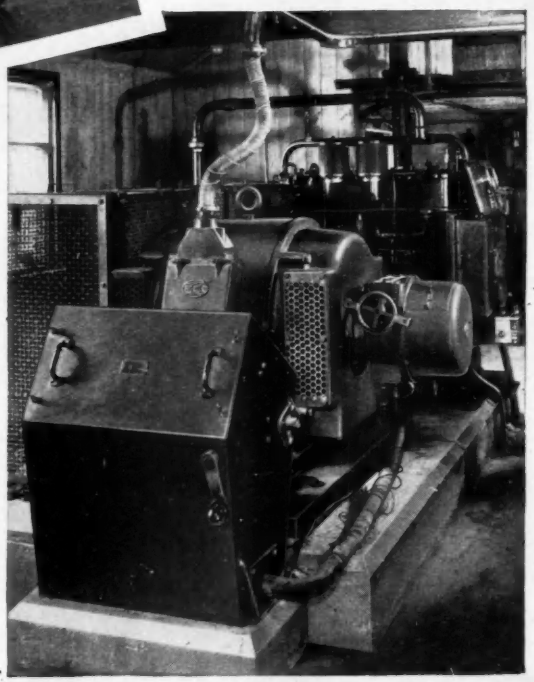


125 HP. ECC Slip Ring Motor, 720 RPM., Driving No. 2 Holman TM 60S. Two Stage Compressor, displacing approximately 400 cu ft per min. to drive quarry drilling Machines.



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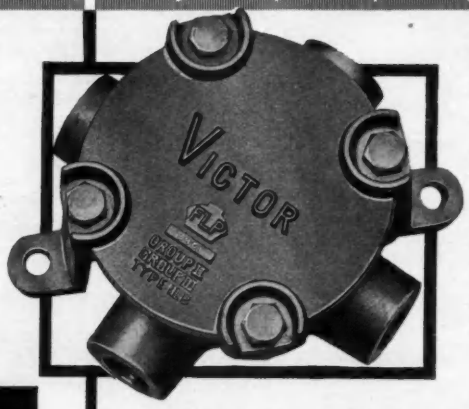

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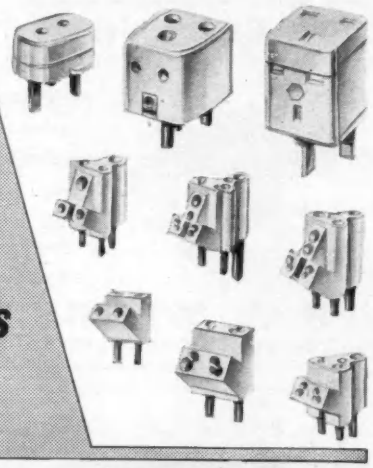

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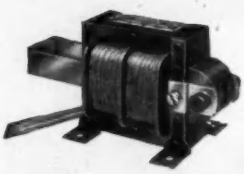

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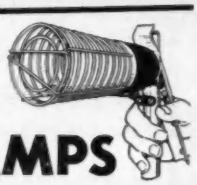

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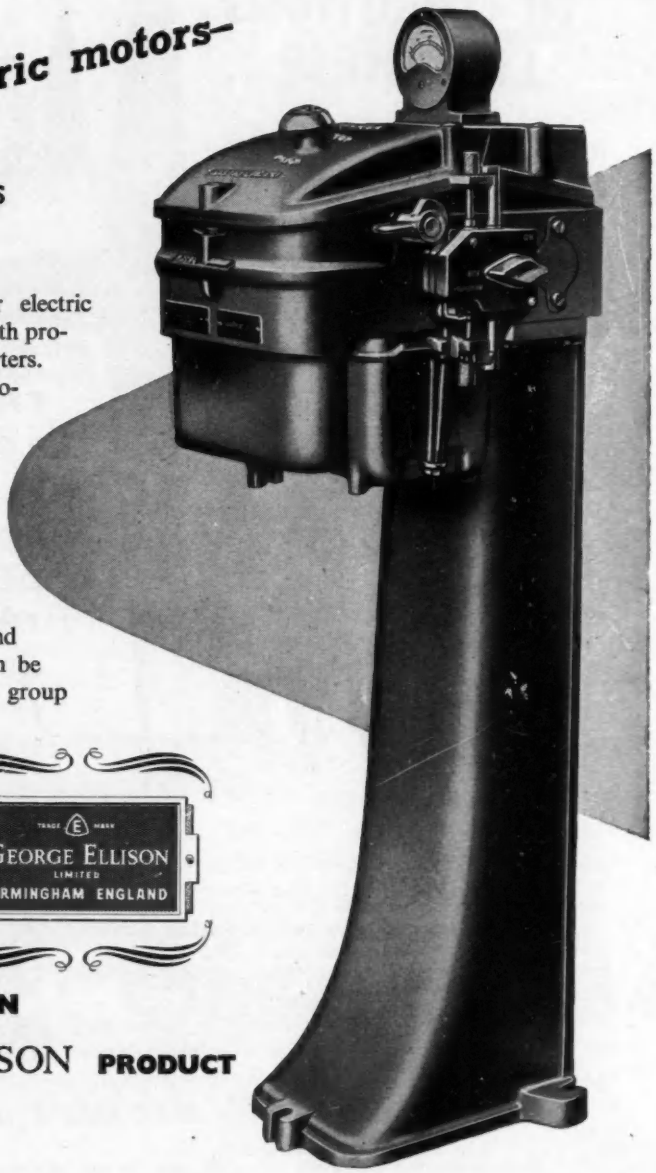

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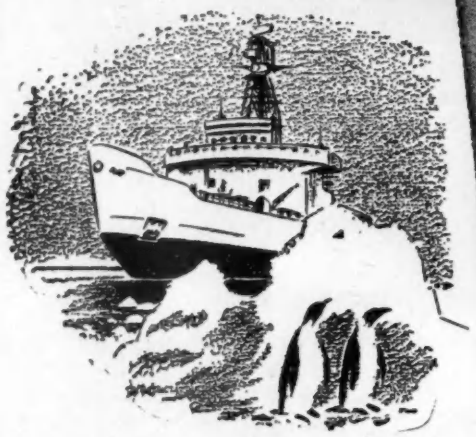

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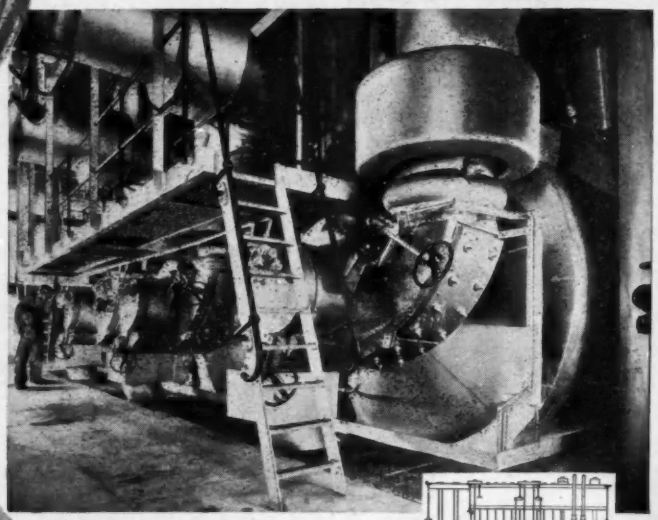

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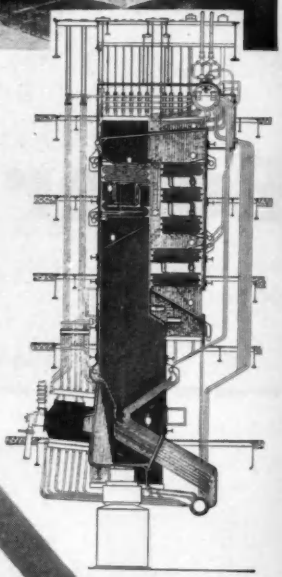

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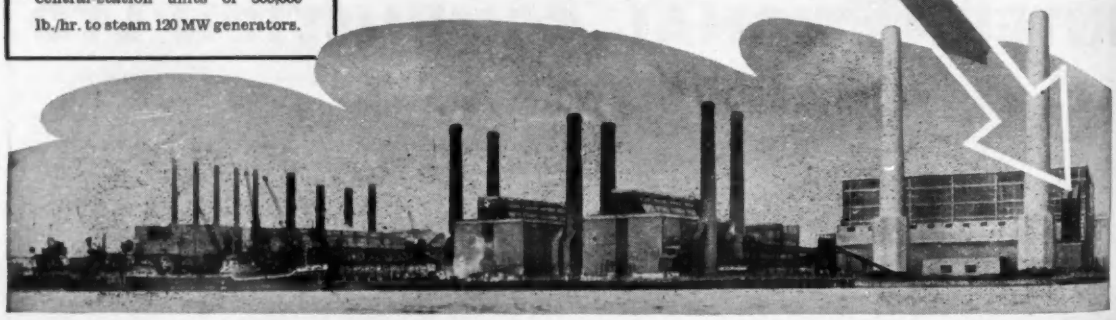
BABCOCK *Cyclone-fired* **BOILERS**



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20 JUNE
1958

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

In This Issue

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British Electrical Power Convention	1155	Illustrated report of the opening proceedings at Brighton with abstracts of the presidential address and Convention papers on nuclear energy in Great Britain, nuclear energy overseas, British hydro-electric plant and world requirements, and the electrically equipped kitchen
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VOLUME 162 NUMBER 25 ✧ *Eighty-Sixth Year of Publication* ✧ FRIDAY PRICE 1s 6d

Editorial, Advertising and Publishing Offices: Dorset House, Stamford Street, London, S.E.1. Telegraphic Address: "Elecrev, Sedist, London." Code: ABC. Telephone No. Waterloo 3333 (60 lines). Registered at the General Post Office as a Newspaper. Entered as Second Class Matter a the New York, U.S.A., Post Office. Annual Subscription: Home £4 15s 0d; Overseas £5 15s 0d; U.S.A. and Canada $16.00. Cheques and Postal Orders (on Chief Office. London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD. and crossed "Lloyds Bank."

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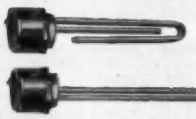

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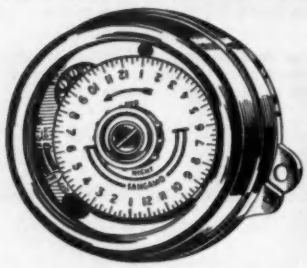

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ELECTRICAL REVIEW

20 June 1958 Vol. 162 No. 25 Established 1872

Achievement and Opportunity

AT a time when world conditions are not too bright and the prospects seem to be doubtful it is stimulating to have such a tonic as that provided by Sir George Nelson in his presidential address to the British Electrical Power Convention this week. While recognising that difficulties beset the path of the electrical industry, he seemed to have little doubt that the industry would continue to thrive and expand.

His text was the theme of the Convention, "Electricity and World Progress—Britain's Contribution," and naturally the address reviewed past achievements, not as a sort of memorial, but as an indication of what this country was still capable of doing. He did not indulge the frequently-held idea that the world recognised our past greatness and would automatically turn to us for their needs. He stressed the necessity for constant alertness if our progress was to continue. A great deal of familiar ground was covered but the address was charged with original thought derived from long experience in engineering and international trade.

Sir George spoke of the great contribution of British workers in the realm of fundamental science but in doing so pointed out that, by and large, the industrial and commercial applications of scientific discovery had lagged and other countries had worked on them. Against this could be set such notable achievements as the 132 kV grid and our railway electrification schemes in which we led the world and at the same time provided experimental and testing systems of immense value to manufacturers in meeting overseas requirements.

Apprehension of the effect on our export trade of our overseas customers producing their own equipment was not shared by Sir George, who thought it likely that local manufacture would ultimately lead to a greater demand for imported equipment, although possibly of different classes. We had to adapt ourselves to such changes.

No address of this kind could ignore the subject of education and training and Sir George showed himself to be among those who deprecated the segregation of technologists and administrators into rigid classes. Engineers and scientists should have some regard for other facets of life and the non-scientific men in industry should acquaint themselves with what was going on in the realms of science and engineering.

Great as had been our past, Sir George saw no reason for looking back with longing for he thought that young men to-day had greater opportunities for service to the world than had the young men of his own generation.

CENTRALISED CONTROL

It is only comparatively recently that unit operation was introduced in this country, i.e. one boiler feeding one turbo-alternator set with no steam interconnections between adjacent boilers. As the reliability and flexibility of automatic and remote control apparatus has increased there has been a tendency in modern unit type generating stations to provide unit control rooms, usually at operating floor level and between the turbine and boiler, from which the turbo-alternator and boiler together with all associated auxiliaries are operated as a single unit. Normally there is one plant control room for each unit, but in some stations two units are operated from a common control room. The plant control room is, of course, separate from the main electrical control room where synchronising and switching of the alternators is carried out.

In an endeavour to improve operational efficiency still further, there now appears to be a tendency to combine the plant control room and the main electrical control room into a single central control room for the entire plant. This is evident from the description of the South Denes generating station which we publish in this issue. The construction of centralised schemes of this kind has been made possible only by the introduction of miniature remote control and indication devices, and although equipment of this type can be made to have a high degree of reliability, we shall no doubt have to wait for several years before we can be sure that it is right to concentrate a vast quantity of highly specialised light current apparatus into a very small space and using this to control, say, £15 million worth of generating plant.

TRANSPORT LIMITATIONS

Restrictions on the weight and size of major components of electrical and associated equipment imposed by railway carrying capacity are posing problems in most countries. This much is clear from papers presented at this year's C.I.G.R.E. and from reports received by us lately from other sources. The apparently simultaneous international appreciation of the effects of transport deficiencies on the design of very large generating sets and transformers no doubt arises from two main causes. One is that the most highly industrial countries are approaching a stage in electrical development that will enable them to exploit the advantage in capital and running charges of adopting very large units. The other reason is presumably the interest taken by these countries in aiding the advancement of other lands in an earlier stage of development, where existing methods of transport are inadequate for coping with smaller plant items.

OUT OF EVIL

Attempts now being made to adapt established engineering designs to unavoidable handicaps determined by outside causes, such as transport limitations, offer promise of an overcoming of these difficulties sooner rather than later. Some of these were referred to in our leading article of 6th June. This result would only be in accordance with (although technically more complex than) the many instances in engineering history in which a compulsive deviation from the normal line of progress has led, through inventive ability, to improvements in other ways.

That engineers and scientists have the skill and the determination to surmount obstacles to progress of this kind has, of course, been demonstrated in the building of commercial atomic power stations. But for the fear of a future coal shortage, Britain would not to-day be leading the world in this sphere of power production and gaining experience in design, construction and operation.

BIRTHDAY HONOURS

Last week's list of the Queen's Birthday Honours contained a fair sprinkling of electrical names—rather more than usual as will be seen from our notes on page 1179. No doubt in recognition of his eminent services to the electricity supply industry Lord Citrine is promoted to Knight Grand Cross of the Order of the British Empire. Among the new knights are the well-known figures of Dr. Willis Jackson and Mr. J. S. Pickles. Another prominent electricity supply man, Mr. Denis Bellamy, is promoted from O.B.E. to C.B.E., and other new Commanders of the Order are Messrs. E. K. Cole, G. A. Wilson and T. A. Coughtrie. To these and the many others in the list we offer our congratulations.

ELECTRIC STREET TRANSPORT

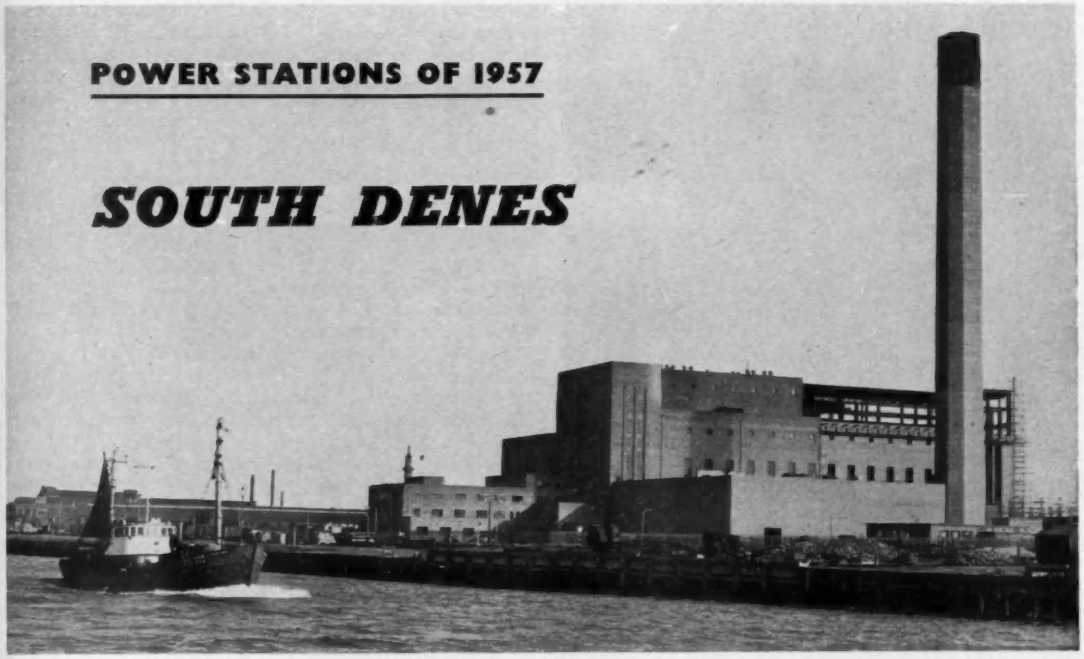
While electrification of the railways is being carried out as expeditiously as possible electric street transport is being pushed further into the background. The controllers of both private and municipal systems are strongly committed to the use of oil-engined vehicles and they have been encouraged in their attitude by the decision of London Transport to progressively (or retrogressively) abandon London's trolley-buses.

Yet the case for trolley-buses, and for trams in suitable areas, is still a strong one. These vehicles are not dependent upon imported fuel, they do not pollute the atmosphere, they are smooth-running, silent and free from vibration, and generally their capacity is greater than that of oil buses. In short, they are worthy of greater consideration than they seem to be getting.

LIBRARY CLASSIFICATION

With the ever-increasing range of knowledge, it is becoming more difficult for librarians to classify technical books correctly. The universal decimal system is a great help but the classification number given to a particular book depends on the librarians' individual assessments and these can vary widely. This difficulty can be solved if the practice of publishing the decimal classification on the title page becomes widespread.

With regard to publications on electrical subjects the Institution of Electrical Engineers uses the system and the catalogue provides a useful source of reference. The decimal classification of new books appears regularly in the *I.E.E. Journal*. The adoption of this system throughout the country would greatly help researchers and students, particularly where librarians are not technically qualified.



South Denes power station from River Yare

CONSTRUCTIONAL PROGRESS ON 240 MW OIL-FIRED PLANT

THE first 60 MW turbo-generator/boiler unit was commissioned last September at the South Denes (Yarmouth) power station of the Eastern Division, Central Electricity Generating Board. The complete installation will consist of four 550,000 lb/hr oil-fired boilers, each connected to a 60 MW turbo-generator with steam conditions of 900 p.s.i. and 900 deg F at the turbine stop valve.

The station was originally designed for coal firing but, in 1955, it was decided to convert to oil firing using residual oil with a viscosity of 6,000 sec Redwood No. 1. Although the coal handling, pulverising, and ash handling plants were not installed, provision has been made in the design for their accommodation if it is found desirable to reconvert the station at some future date. The coal bunkers have, however, been installed in the boiler house on the side remote from the turbo-generators.

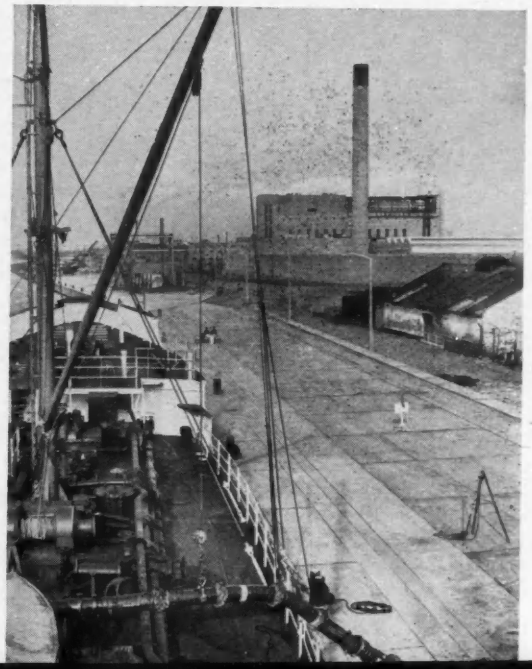
The main station occupies a site of 19·5 acres with a separate site of 12·5 acres, originally intended for coal storage, on which the first of three oil storage tanks is installed. Both sites are on a narrow strip of land between the River Yare and the North Sea.

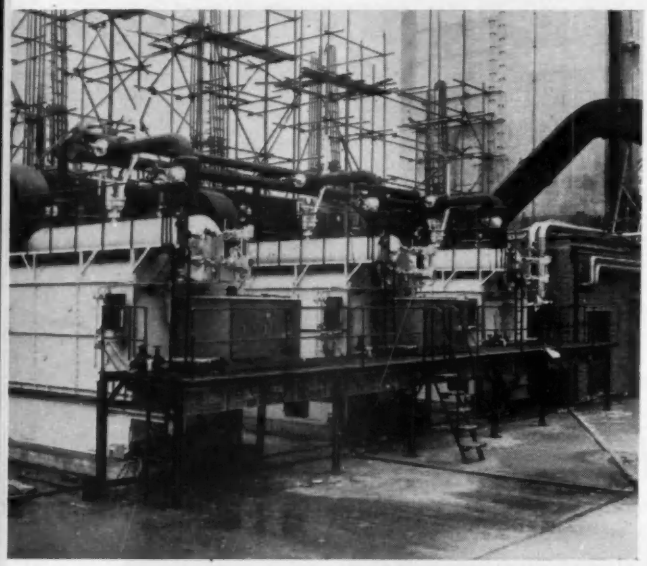
The subsoil is firm sand to a depth of at least 300ft and the main foundation consists of a reinforced concrete raft, 2ft 6in thick, placed just below water level to give stabilised conditions with the circulating culverts formed below this raft. To construct the foundations, the water level of the subsoil was lowered by the wellpoint system of dewatering using suction pumps at ground level drawing from 2½in diameter vertical tubes fitted with filters at the lower ends.

The main buildings are steel-framed structures clad in Essex Primrose bricks. The roof is of galvanised steel decking covered with insulating material and stone chippings. The boiler house roof is 130ft and the turbine hall roof is at 83ft above basement level. The turbo-generators are arranged transversely at 70ft centres and are served by a 135 ton crane with a 20 ton auxiliary hoist. The administration block is to the west of the main building and the 360ft chimney is situated on the building centre line to the south of the site.

Fuel oil is delivered by ocean-going tanker to a 700ft wharf, orginally constructed to handle colliers. From the wharf the oil is pumped to the storage tank and from this tank to the main station through pipes which are laid in a

Tanker unloading oil at the 700ft wharf





Auxiliary water boilers used for the tracing of fuel oil pipelines and for heating the oil before delivery to the boiler burners

tunnel. This tunnel was originally constructed to accommodate coal conveyors. To maintain the oil in a fluid state, hot water tracing is provided by auxiliary boilers placed adjacent to the chimney. The boilers produce the hot water at a pressure of 250 p.s.i. and 400 deg F. Other oil pumps and heaters are used to condition the oil for delivery to the boiler burners.

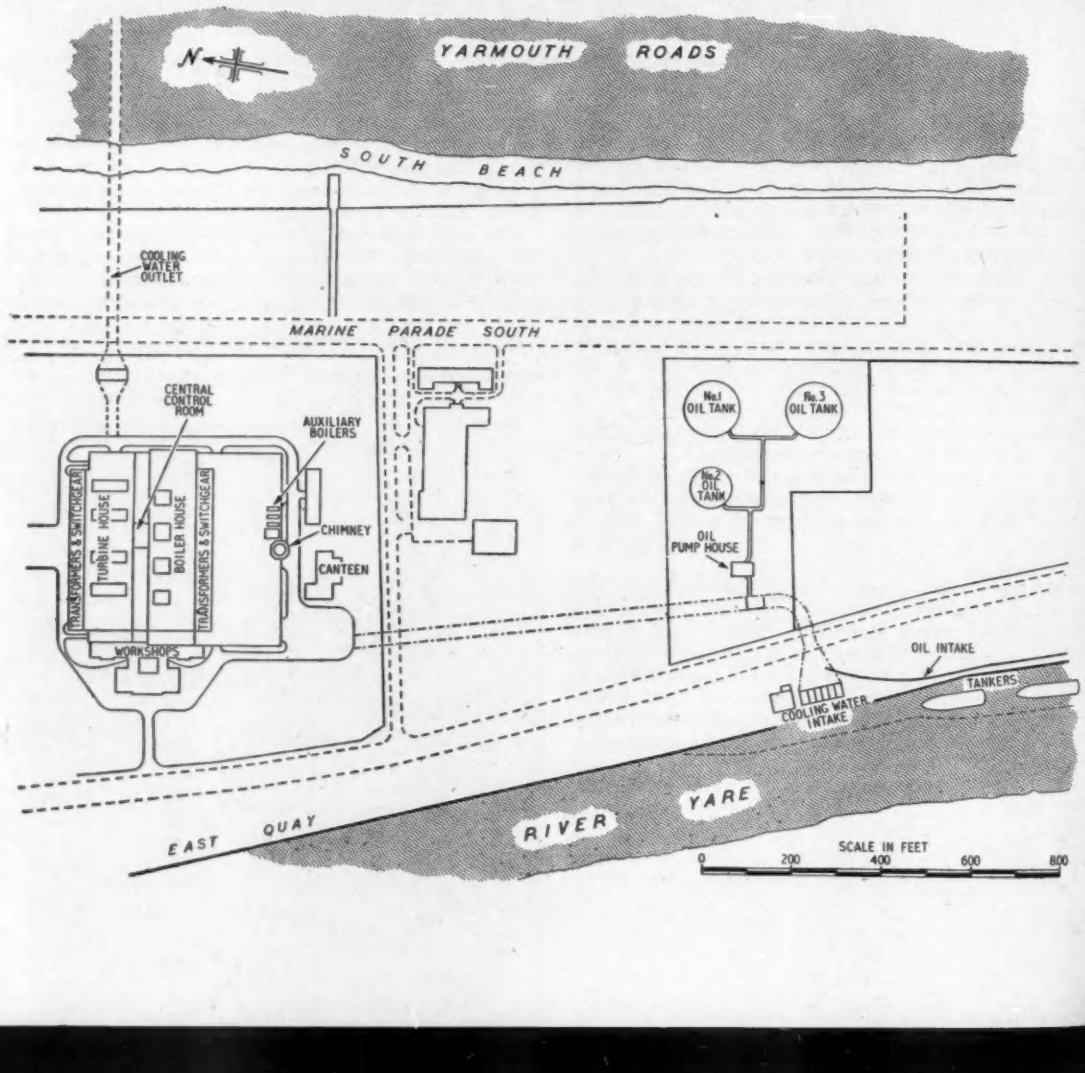
Steam-Raising Plant

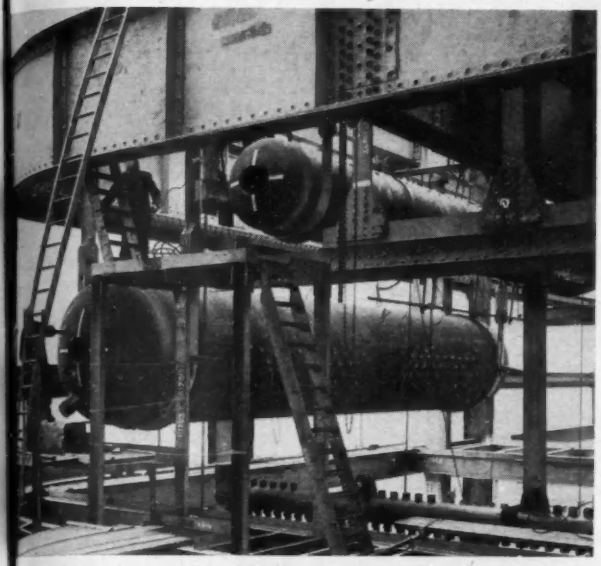
The completed station will accommodate two three-drum boilers by International Combustion, Ltd., and two two-drum boilers by Mitchell Engineering, Ltd. Each has a maximum continuous evaporative capacity of 550,000 lb/hr, the pressure and temperature of the steam at the superheater outlet being 950 p.s.i. and 910 deg F with a final feed temperature of 385 deg F.

The water-cooled combustion chambers of the two I.C.L. boilers now installed are of finned tube construction, 1in fins being welded diametrically opposite on the 3¼in o.d. tubes. The furnace dimensions are 78ft high by 27ft wide by 21ft deep. Due to the change to oil firing the original effective water cooling surface exposed to radiant heat of 10,440 sq ft has been slightly reduced by the introduction of a furnace hearth positioned half-way up the ash chamber. A brick-lined pass to the rear contains the primary superheater and a double-banked economiser.

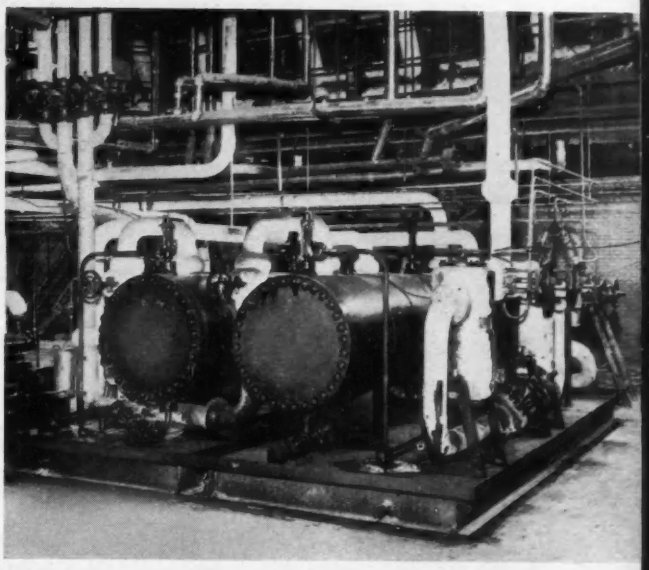
The three-stage superheater supplied by the Superheater Co., Ltd., comprises a horizontal self-draining primary superheater in two stages and a pendant secondary superheater. The original total effective heating surface

Fig. 1.—Site plan of the South Denes power station





Construction of one of the two-drum Mitchell boilers



Fuel oil heating and pumping unit

of the superheater was increased on conversion to oil firing from 17,360 to 19,500 sq ft. Control of the temperature of the superheated steam is achieved by tilting the oil burners, with trimming by spray type desuperheaters. The gilled tube economiser, supplied by Senior Economisers, Ltd., has a heating surface area of 52,000 sq ft.

Each boiler is provided with two Howden-Ljungstrom rotary type air heaters with the elements fitted in containers to simplify maintenance. The dust extraction equipment consists of two multi-cellular units of the cyclonic type, but the electrostatic precipitators have not been installed. Dust is removed from the boilers by vacuum plant and is disposed of by road.

The two main boiler drums are each fitted with local, direct-mounted water gauges, the rear drum also has a Hopkinsons remote water level indicator and an Igema water level indicator both situated at operating floor level with the Hopkinsons gauge repeated in the control room. Isolating and control dampers are operated from the control room by Ipscol actuators. Feed water control is achieved by the Copes " Flowmatic " system.

Twenty-six electrically-operated Hopkinsons soot blowing units are controlled automatically in sequence from a panel situated in the central control room. Steam for soot blowing is taken from the secondary superheater inlet header.

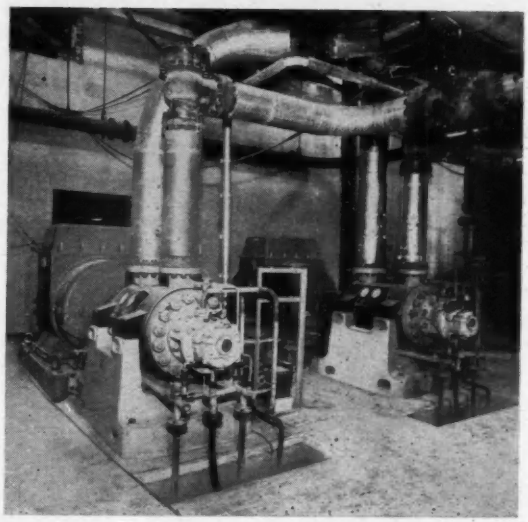
There are five Hopkinsons " Hylif " torsion bar safety valves on the rear drum and three on the superheater outlet header, one of which is electrically assisted. There is a Hopkinsons high/low level alarm fitted to the drum.

Each boiler has twenty-eight oil burners made by Peabody, Ltd., arranged with seven in each corner. The burners are pressure atomised, but for cold starting-up purposes the lower burner in each corner can be arranged as an air atomising burner. Oil supplied from the main oil pumps at a pressure of 450 p.s.i. and 260/280 deg F, is boosted to 600 p.s.i. by a constant differential pump when operating on full-load conditions of 46,000 lb/hr. All burners are gas/electric ignited and are inserted by remote control from the main control room. Ignition failure of individual burners is detected by a photo-electric cell which automatically shuts off the oil supply, and withdraws and air purges the burner.

Each boiler is equipped with two Howden induced draught fans at basement level driven by Laurence, Scott 450 h.p., 740 r.p.m., 3·3 kV squirrel-cage motors with hydraulic coupling control. The output of each of the two forced draught fans, situated half-way up the boiler and driven by similar 240 h.p., 985 r.p.m. motors, is controlled by inlet vanes.

Unlike the I.C.L. boilers described above, the Mitchell boilers have been designed since the station was converted to oil firing and the oil-burning equipment will be supplied by Associated British Combustion, Ltd. There will be

Boiler feed pumps, No. 1 set



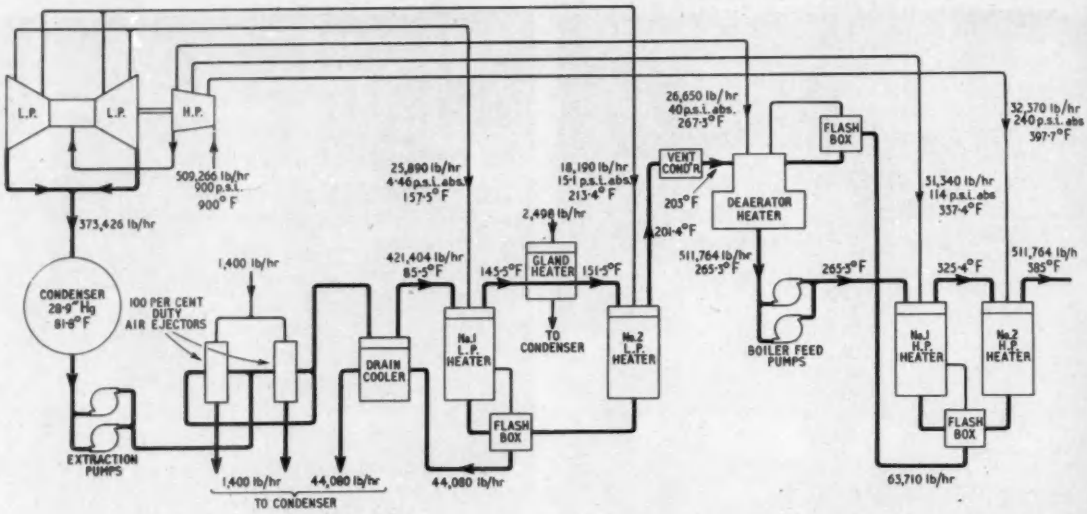


Fig. 2.—Heat balance diagram for 60 MW set at maximum and continuous economic rating

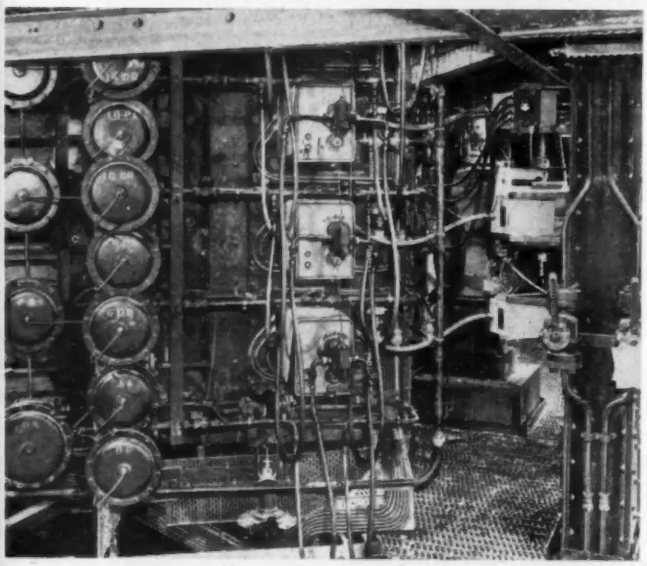
12 pressure atomised oil burners in the furnace front wall with h.t. spark ignition.

The automatic control equipment for all boilers is supplied by Bailey Meters & Controls, Ltd., and is situated in the central control room described below.

Turbo-Generators

The four 3,000 r.p.m. turbo-generators are hydrogen cooled at 15 p.s.i. and are designed to operate with steam at 900 p.s.i. and 900 deg F at the turbine stop valve with 28·9in vacuum and a final feed temperature of 385 deg F. The first two machines are being supplied by the Metropolitan-Vickers Electrical Co., Ltd. The specified steam and heat consumptions when delivering 60 MW at 0·8 power factor lagging are 8·5294 lb/kWh and 9,314·5 B.Th.U./kWh respectively. The high- and low-pressure turbine rotors are rigidly coupled together and the two impulse-type cylinders are provided with annular steam belts at the various extraction points and twin exhausts. The machine is rigidly fixed at the bearing at the alternator end of the low-pressure cylinder.

Three of the oil burners on No. 1 boiler



Emergency stop and governor valves of the balanced pressure type are provided. The emergency valves are operated automatically by duplicate emergency overspeed governors on the main turbine shaft set to operate at 3,300 r.p.m. The emergency valves may also be tripped instantly by hand. Speed variation is effected by a centrifugal governor operating the governor valves through an oil relay system. Hand- and motor-operated speed control gear enables the turbine speed to be raised or lowered by 5 per cent above or below normal while the machine is running.

To provide the turbine operator with a guide to conditions regarding axial expansion, running clearances and the degree of eccentricity of the rotor, a comprehensive system of supervisory control is installed, indicating and recording equipment being mounted in the central control room.

Twin condensers of Vickers-Armstrongs manufacture are provided for Nos. 1 and 2 sets. They are of the two-pass type and the total cooling surface is 57,000 sq ft, the design circulating water temperature being 60 deg F. The tubes are of Yorkalbro 1in o.d., 18 s.w.g. and 23ft 6in long, expanded at the inlet ends and packed at the outlet ends. There are two 100 per cent duty, vertical spindle, two-stage "Pervac" extraction pumps. The two three-stage Weir air ejectors have surface intercoolers, and one quick-start air ejector is provided for each turbine.

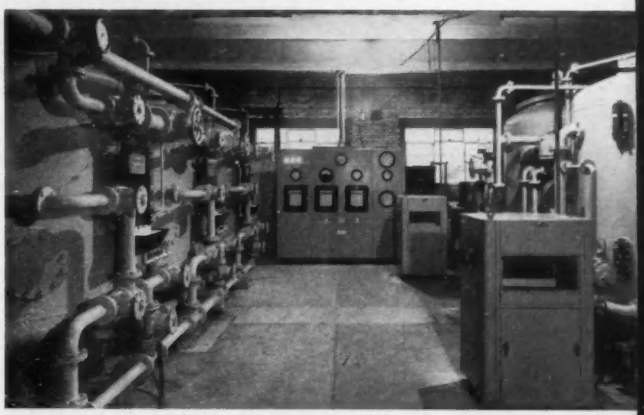
The feed heating train consists of four surface heaters and one direct contact de-aerator heater supplied by Vickers-Armstrongs, Ltd. Condensate is pumped from the condenser at 81·8 deg F and is fed through one air ejector, drain cooler and two l.p. heaters and gland heater, to the high level de-aerator heater. From there it passes through a feed pump to the two h.p. heaters and then to the boilers. Make-up is introduced to the system at the condenser through the reserve feed tank.

Associated with each turbo-generator unit are two

100 per cent duty motor-driven boiler feed pumps, each capable of delivering feed water at the rate of 625,000 lb/hr and 1,410 p.s.i.

Nos. 3 and 4 turbo-generators, feed heating and condensing plant are being supplied by Richardsons, Westgarth (Hartlepool), Ltd. The machines are of the two-cylinder combined impulse and reaction type. The l.p. cylinder has a multi-flow single exhaust connected to a single two-pass condenser.

The first three machines are being equipped with two Aiton double-effect low-pressure salt water evaporators with an evaporator condenser situated in each feed water heating train. The distillate produced is passed through a John Thompson "Kennicott" ion exchange water treatment plant which can also handle small quantities of town water in an emergency.



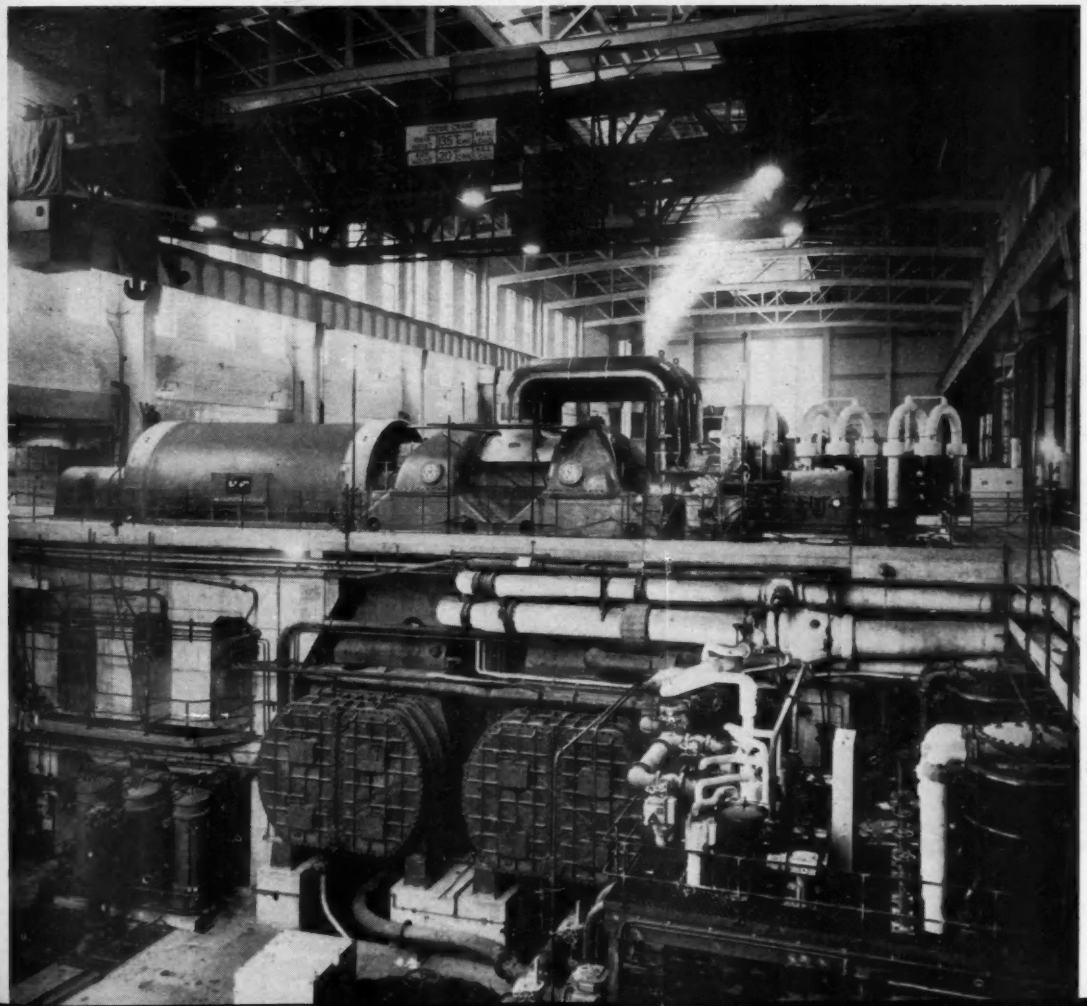
Water treatment plant

Circulating Water System

Circulating water is taken from the River Yare through six vertical band screens and flows to the main station in twin culverts. Two 50 per cent duty circulating water pumps, each of 22,500 gal/min capacity, are placed adjacent to each machine and discharge through the condenser to the sea via culverts at 150 yd below low-water mark.

The circulating water pumps are of special interest. They are Vickers-Gill two-stage axial flow sets with variable pitch. The pitch adjustment of the blades enables the characteristics of the pumps to be altered to give optimum pumping conditions. Pitch adjustments can be carried out automatically, the controlling influence being condenser vacuum. On Nos. 1 and 2 machines valves are provided at each pump discharge with butterfly valves at the condenser outlet. The live discharge mains

60 MW turbo-generator showing condensers and feed heaters



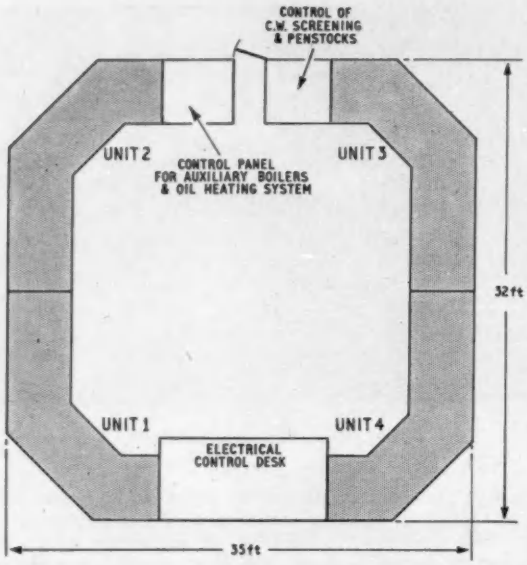


Fig. 3.—Plan of central control room

can be interconnected. On Nos. 3 and 4 sets, the discharge mains will not be interconnected and only the vented condenser outlet valves will be provided. These valves ensure that the condenser top tubes are not uncovered under extreme low tidal conditions.

A heat pump plant taking heat from the outlet of the circulating water provides heat for the administration block.

Central Control Room

The main control room at South Denes is of special interest as the station is one of the first designed to include all boiler-turbine unit control panels as well as the main electrical control panel in the same control room. Starting-up and control of the boiler-turbine unit is completely carried out from the unit console. The position of this control room is shown on the site plan and is approximately on the centre line of the building between the turbines and boilers at operating floor level. The control room is clad in metal-faced acoustic tiling and a ventilating and air-conditioning plant has been installed.

The layout of the control room is illustrated and shown in Fig. 3. The boiler-turbine unit console type desks are placed across the corners of the room, each unit occupying one corner. With this arrangement, the unit operator can observe from one position all instruments associated with the unit. When facing the unit console, the turbine controls and instruments are to the left and those for the boiler to the right, with those controls and instruments in frequent use on the centre sections. Essential instruments on the centre portion include water level gauge, steam pressure and temperature gauges for superheater outlet and turbine stop valve, auto/manual superheat control, auto/manual selector for Bailey Meters boiler control, steam flow/air flow meter and an emergency stop button.

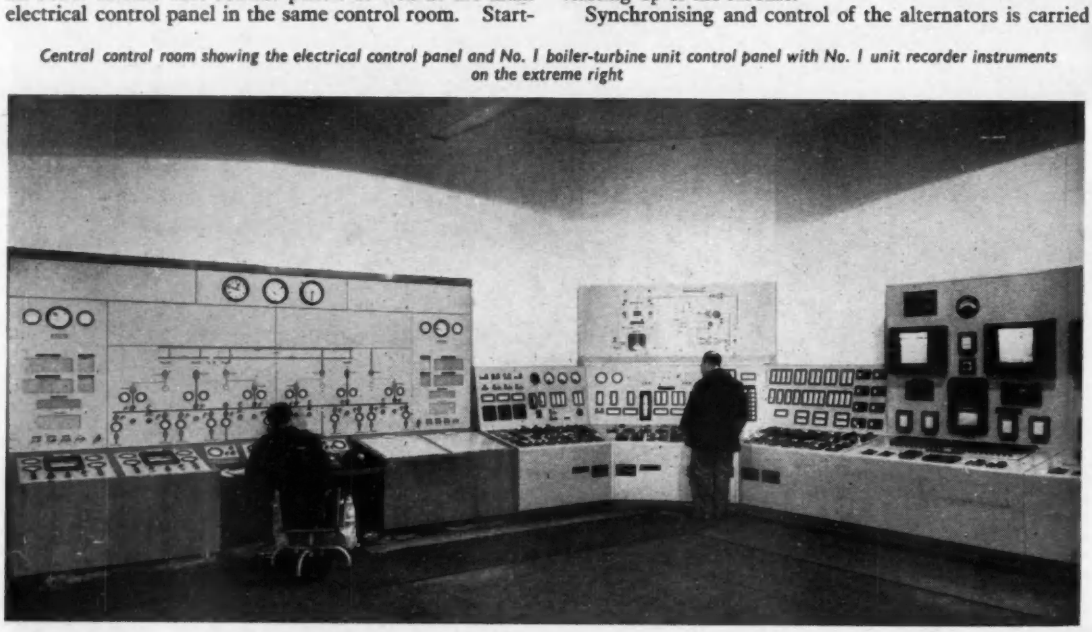
The controls are situated on the desk portion of the console and the indications on the vertical face. Miniature type instruments, controls and indications in many cases of special design are used throughout to accommodate all necessary items in the limited space. Instruments and control units have been made for front withdrawal as there is insufficient room to service them from the rear. Withdrawal of the control units is facilitated by the use of Plessey plugs. All controls and indications are transmitted electrically and there are no steam or water connections to the control room. Control of certain valves would have been desirable, but due to space limitations, indications only have been provided. An extensive system of visible and audible alarms has been supplied by Standard Telephones & Cables, Ltd.

As mentioned earlier, the oil burners are operated from the control room by selector switch and push-button control with indication that the flame has stabilised.

The control system for Nos. 3 and 4 units is planned to incorporate a sequence control switch for automatic starting-up of the turbine.

Synchronising and control of the alternators is carried

Central control room showing the electrical control panel and No. 1 boiler-turbine unit control panel with No. 1 unit recorder instruments on the extreme right



out at the electrical control panel in the central control room. The panel includes visible and audible alarms, switching control and instrumentation together with a mimic diagram. Relay and interposing equipment are housed in a room immediately below the central control room.

Nos. 1 and 2 generators are each solidly coupled to a 72 MVA, 11·8/35·4 kV generator transformer and a 5 MVA, 11·8/3·42 kV unit transformer. The generator transformers feed on to the 33 kV busbars of the existing Yarmouth switching station which in turn feeds one 7·5 MVA, 33/3·45 kV station transformer.

Nos. 3 and 4 generators will be solidly coupled to a 72 MVA, 11·8/132 kV generator transformer which will feed a new 132 kV switching station. The 132 kV busbars will be interconnected with the existing 33 kV switching station.

The station was designed by the engineering staff of the C.E.G.B., Eastern Division, the architectural treatment being under the direction of the divisional architect, and Messrs. Rendel Palmer & Tritton are acting as civil engineering consultants.

Main contractors are:—Civil engineering works, Peter Lind & Co., Ltd.; superstructure, Richard Costain, Ltd.; steelwork, Dawnays, Ltd.; boilers Nos. 1 and 2, International Combustion, Ltd.; boilers Nos. 3 and 4, Mitchell Engineering, Ltd.; turbo-generators, Nos. 1 and 2, Metropolitan-Vickers Electrical Co., Ltd.; condensers and feed heaters, Nos. 1 and 2, Vickers-Armstrongs, Ltd.; turbo-generators, condensers, and feed heaters Nos. 3 and 4, Richardsons, Westgarth (Hartlepool), Ltd.; auxiliary cables up to 3·3 kV, B.I.C.C.; main generator transformer, British Thomson-Houston Co., Ltd.; auxiliary transformers, Bryce Electrical Construction Co., Ltd.; station transformer, Johnson & Phillips, Ltd.; 415 V switchgear motor control equipment, Brookhirst Switchgear, Ltd.; 3·3 kV switchgear, English Electric Co., Ltd.; 132 kV switchgear, Metropolitan-Vickers Electrical Co., Ltd.

Turbine room switchgear annexe with 3·3 kV gear

Wiring Regulations Interpretations

THE fifth group of interpretations of the I.E.E. Regulations for the Electrical Equipment of Buildings (13th Edition), issued on 9th June, are of general interest and involve clear-cut issues.

Basic requirements for the consumer's main switchgear are indicated in Regulation 101 and Regulation 102(A), whilst Regulation 102(B) indicates the general sequence. Where Regulation 105 is applicable, the consumer's main fuse(s) may be omitted subject to the provisos indicated, and this practice is supported by Note 2 to Regulation 102(A). A linked earth-leakage circuit-breaker complying with B.S. 842, which has an operating handle, can take the place of the consumer's main switch, provided (a) it is arranged for ready operation (see Regulation 7) and (b) it breaks the number of poles required by Table 2 on page 96.

These relaxations are admissible only if the current rating of the earth-leakage circuit-breaker and of the cable between the meter terminals and the consumer's circuit fuses is not less than the rating of the service fuse, in accordance with Regulation 108, subject to the application, where appropriate, of exemption (vii). With these limitations, the use of an earth-leakage circuit-breaker without overload features is admissible provided the supply undertaking agrees. Additional recommendations for good practice are made in Code 322.103 "Installation of Consumers' Electricity Supply Controls for Small Dwellings (for A.C. Systems)."

It has been suggested that Regulation 104 precludes the use of a double-pole linked switch for isolating a single-phase circuit from the supply, unless the neutral pole makes first and breaks last. Such an arrangement of the neutral pole is usual for three-phase-and-neutral circuits, and it is appreciated that this is necessary to prevent possible danger due to voltage rise on an unbalanced circuit at the moment of break. For single-phase circuits, however, no voltage rise can occur even if the neutral breaks momentarily before the line, and it is confirmed that a double-pole linked switch with simultaneous break of live and neutral conductors meets the requirements of Regulation 104.

During the currency of the 12th edition it was ruled that it was permissible to wire a spur directly from the terminals of the 30 A fuse protecting a ring circuit. Clause 2 of Regulation 114(B) of the 13th edition of the Regulations states, however, that "spurs shall be connected to a ring circuit in socket-outlets, or in suitable joint- or junction-boxes." For the purposes of this Regulation, fusegear may be regarded as constituting a joint box (see definition on page 12), but the terminals must be capable of anchoring the number of conductors concerned in accordance with Regulation 207.

Heat Transfer Calculations

A DESCRIPTION of a graphical method of calculating heat transfer, condensation and vaporisation rates in processes involving water-steam-air mixtures has been presented to the Institution of Mechanical Engineers by Dr. D. B. Spalding (Imperial College, London). The method entails the use of a chart of enthalpy against composition for air-water mixtures, an example of which, valid for atmospheric pressure, is given in the paper, and data are included from which charts for other pressures may be calculated. Applications of the chart to problems include those affecting steam drums, cooling towers and condensers.

Electricity from Nuclear Fuel

Observations on the Possible Economics of Low Fuel Cost Electricity

By G. T. SHEARS, M.I.E.E.*

THE nuclear reactor is an alternative to the coal or oil burning furnace of an otherwise conventional thermal generating station. Heat liberation in a reactor is a physical process quite different from the chemical oxidation of coal in a furnace. Nevertheless, the energy of fission is manifest as heat and thereafter the conversion to mechanical and finally electrical energy involves a heat engine with associated thermodynamic and heat transfer problems.

The uranium which undergoes fission in a reactor has a "calorific value" far greater than that of coal; in fact, a ton of natural uranium, in a graphite-moderated reactor, should yield about 20 million kWh of electricity compared with about 2,150 kWh for the burning of a ton of coal. The ratio of 10,000 to 1 in favour of uranium is impressive, but it is necessary to appreciate more fully what is involved when a fissile material is used to produce heat.

The reactors developed in Britain are graphite-moderated, gas-cooled devices which use natural uranium as fuel. The uranium therefore contains 0·7 per cent of the fissile isotope 235 and the remainder is the fertile isotope 238. When fission occurs the 235 content is progressively dissipated but some of the 238 is transmuted by neutron capture into plutonium which is another fissile element. If burn-up is maintained the formed plutonium will undergo fission and produce heat plus higher isotopes of the same element. Some isotopes are fissile, but others are not and only act as neutron absorbers. It is, therefore, a complicated matter to calculate from first principles the heat per unit weight of uranium.

The fission process also produces a variety of other elements, many of which are active, and these fission products can be likened to "ash" which will slow up fission by absorbing neutrons. Cartridges discharged from a reactor will contain depleted uranium, that is to say uranium which has less than 0·7 per cent of the fissile isotope 235, fission products and plutonium. The spent fuel is valuable and may be processed for separation of the plutonium and depleted uranium: the former to be used as fuel in other reactors and the latter to be enriched by diffusion up to the desired isotopic concentration.

It is apparent that a nuclear fuel cycle involves extensive chemical plants operating under active conditions plus a plant for enriching the depleted uranium. Ultimately, it is probable that fissile material will be obtained from breeder reactors which will convert fertile material into fissile material with an overall gain of the latter.

* Deputy Commercial Manager, United Kingdom Atomic Energy Authority.

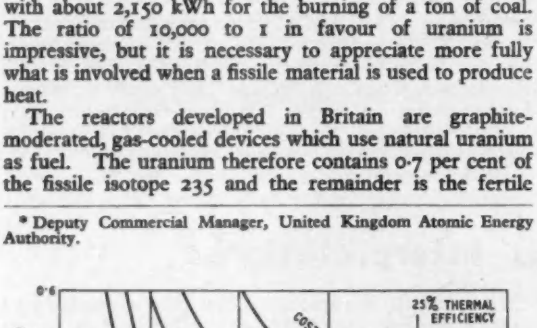


Fig. 1.—Fuel cost in a nuclear plant related to burn-up

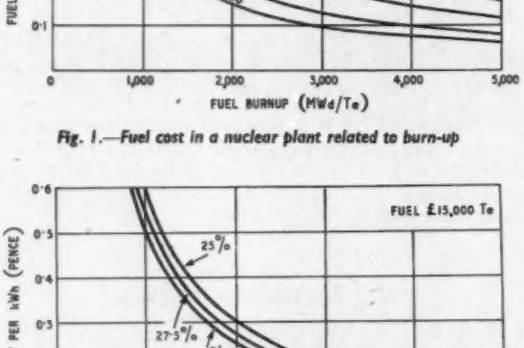


Fig. 2.—Effect of thermal efficiency on fuel cost in relation to fuel burn-up

Cost of Nuclear Fuel

Cartridges of natural uranium suitable to go into a typical British power reactor have been stated to cost about £20,000 per tonne (1,000 kg) of contained uranium. After irradiation in a reactor the fuel is expected to be worth some £5,000 per tonne irrespective of the length of time it has been undergoing fission. On this basis, the net cost of the fuel is therefore £15,000 per tonne and this is the useful figure to the power station operator. A lot has been said and written about the rather elusive value of plutonium and some statements are confused by defence considerations. It is far simpler to deal with net prices and these will be used in the calculations that follow.

The merit of a uranium fuel element lies in its ability to endure irradiation since the heat can be liberated only at a certain maximum rate. Neutron bombardment and the accumulation of fission products subject the container to severe stresses. Remembering that the choice of canning material is limited because of neutron economy, and its environment in the reactor, it is reasonable to assume that metallurgical failure of the can will precede loss of reactivity as a reason for discharging irradiated fuel. If the fuel has an average rating of 2·2 MW per tonne (heat) it must be irradiated in the reactor for four years to give a gross heat yield of 3,000 MW-days per tonne. The vital economic factor is then, how well the fuel will stand up to irradiation.

Fig. 1 shows the fuel cost per kWh of electricity in a nuclear plant with a 25 per cent thermal efficiency plotted against burn-up in MW-days per tonne (MWd/Te is the conventional integrated heat unit in reactor nomenclature; at 25 per cent thermal efficiency (s.o.), 1,000 MWd/Te equals 6 million kWh s.o. and 3,000 MWd/Te equals

Station	Capacity MW(s.o.)	Capital cost £/kW(s.o.)	Fuel cost £	Thermal efficiency % s.o.	Calorific value of fuel	Fuel in reactor(s) Te	Operating cost d/kWh(s.o.)
Coal	360	60	5 (ton)	30·0	11,000 B.T.U./lb	—	0·05
Nuclear	360	120	15,000 (Te U)	27·5	3,000 MWd/Te	595	0·05

18 million kWh s.o.). Curves are plotted for various net prices of fuel and it is obvious that the burn-up obtained is analogous to the calorific value of a conventional fuel. At burn-ups around 3,000 MWd/Te the fuel cost per kWh is about half that of an average coal-fired station even with nuclear fuel at £20,000 net per tonne.

Thermal Efficiency

The 25 per cent thermal efficiency, s.o., used in the calculations associated with Fig. 1 is not ambitious and nuclear stations constructed specifically to produce electricity will have better thermodynamic conditions. The initial steam temperature is the dominant factor in heat engine efficiency and in current nuclear plants this is limited by the maximum operating temperature of the fuel in the reactor. With a maximum can temperature of, say, 800 deg F, it is quite impossible to have steam conditions comparable with those of a good coal-fired plant (1,050 deg F). However, the heat cycle associated with the relatively low-temperature heat source provided by a nuclear reactor is greatly improved by a system with two or more pressures. This arrangement is adopted in the nuclear stations now being constructed and thermal efficiencies up to 30 per cent are probable.

The graphs in Fig. 2 illustrate the effect of various thermal efficiencies on the fuel cost per kWh s.o. and relate this to burn-up of the fuel. With fuel at £15,000 per tonne net achieving a burn-up of 3,000 MWd/Te and a thermal efficiency of 25 per cent the fuel cost per kWh is 0·2d. A station with 30 per cent thermal efficiency will produce energy at this cost with a fuel burn-up of only 2,500 MWd/Te. This suggests that the thermal efficiency of the heat engine plant of the station is still of importance, particularly if a plant experiences premature fuel failures. Increased thermal efficiency can mean increased capital cost and this could conceivably increase the total cost per kWh s.o. since the capital costs of nuclear plant exceed those of coal stations.

From the fuel standpoint it seems reasonable to assume that nuclear stations will produce electricity at a fuel cost of up to 0·2d/kWh. This is attractive compared with coal station fuel costs of, say, 0·5d/kWh. There is, however, the effect of capital charges and it is appropriate to consider these now.

Capital Costs

The method by which these charges are calculated varies, as do the rates of interest and the periods over which plant is amortised. For clarity, and to try to provide uniformity of comparison, the following simple basis is used for the examples.

It is assumed that money will be borrowed at 5 per cent interest per annum and that a sinking fund invested at 5 per cent per annum is set up to repay the principal at expiry of the loan period. All plant is written off in twenty years, therefore for each £100 of capital investment, there is £5 interest plus £3·02 sinking fund payment making £8·02 per annum.

The comparison is made between coal-burning and nuclear stations, both being considered average without any special advantages of siting. The coal-fired station is not on a coalfield and might well be situated on the Thames estuary. The table above gives the essential conditions to enable the calculations to be made.

The coal station costs £21·6 million and therefore incurs an annual charge of £1·73 million. The nuclear plant has an annual charge of twice that of the coal station, namely, £3·46 million, and to this must be added the interest on the value of the fuel charge contained in the reactor(s) for the life of the station. The value of the fuel in the reactor(s) at any time will be 595 × £20,000 because the repayment for spent fuel will not have been made in respect of the resident fuel. The annual cost will be 5 per cent of £11·9 million and this is £595,000. The total capital charges for the nuclear plant are then £3·46 + £0·595 = £4·055 million. A sinking fund is not created for the fuel in the reactors since ultimately it will

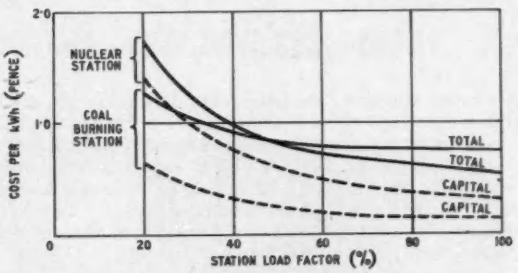


Fig. 3.—Load factor and capital cost of conventional and nuclear stations

be burned up as far as possible and returned for credit at £5,000/Te; it therefore may be regarded as fuel, but the expense of keeping 595 tons of uranium locked up is a capital consideration. (A reactor is analogous to a furnace that will not ignite unless a certain weight of fuel is maintained on the grate, even though the feed of fuel for on-load operation is small.)

Load Factor

The capital cost component of the total cost of electricity depends upon the load factor of the generating plant and in Fig. 3 this is plotted as a dotted line for both types of station. The respective fuel costs are about 0·55d/kWh and 0·182d/kWh in favour of the nuclear plant. The capital costs per kWh s.o. at 80 per cent load factor are 0·165d for coal and 0·386d for nuclear plant. If the fuel and capital costs are summated with the addition of an operating cost of 0·05d/kWh for both stations the total cost at 80 per cent load factor is 0·77d for coal and 0·617d for nuclear generation. The solid lines in Fig. 3 show these total costs and it will be noticed that the nuclear plant appears to have the advantage at load factors in excess of about 50 per cent.

Capital cost changes will have the effect of moving the point of intersection of the two total cost curves along the load factor axis. Similarly with varying fuel costs

but, since fuel is the larger component, in the instance of the coal station a percentage increase in the cost of coal will have a greater effect on the total cost of generation than will a variation in the cost of uranium on the performance of the nuclear plant.

It has been indicated on many occasions that a rising price of coal helps the comparative economics of a nuclear station and also reduces the load factor at which such stations can operate economically.

Admittedly, the comparison outlined here has dealt rather briefly with many of the issues involved in nuclear power: for instance, no reference has been made to the amount of fuel discharged from a reactor in an under-

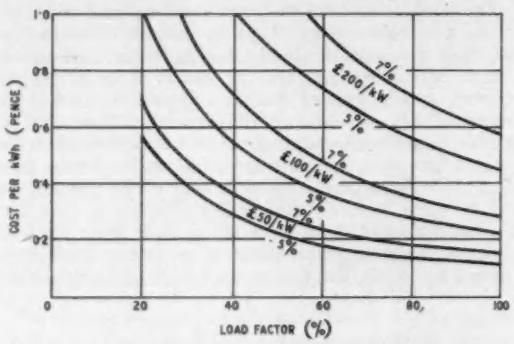


Fig. 4.—Cost per kW plotted against load factor to give kWh cost

irradiated condition to enable the fuel cycle to reach equilibrium; also there is the question of just how much fuel is unburned when the reactor is scrapped. (Ideally, the fuel should be charged into a reactor continuously whilst the spent fuel is discharged at the same rate so that each cartridge is burned up to the design level. To create this equilibrium state some of the initial fuel must be discharged before it is burned up.)

Reference to "fuel shuffling" is omitted but it would be necessary to reorient the fuel in the reactor periodically to ensure even burn-up of the charge. This is because the neutron flux concentrates at the centre of the core. To some extent this is alleviated by flattening the flux distribution curve by introducing strategically-placed absorbers into the core.

The thermal efficiencies of both stations are taken as constant over all load factors and this is unlikely to be so in practice. In spite of these abridgements, it was felt worth while to outline the main considerations in general terms.

The Future

Clearly, the future of national electricity supply is closely linked with the cost of capital equipment and with the realisable burn-up from nuclear fuel. Reactors under development are likely to cost less in capital investment and higher thermal efficiency will be possible because of increased temperature. Enriched fuel can contribute to reducing the size and cost of nuclear power plant units but it is costly. The cost of fuel can be justified readily if the burn-up is long enough.

Coal station plant will probably become cheaper per kilowatt because of the development of very large boilers and sets, but the price of coal itself is unlikely to drop because the winning of coal is a social problem rather than an engineering matter.

If the standard of living in the United Kingdom is to be increased the consumption of electricity per head of population must continue to rise. Assuming that progress in nuclear engineering allows the utilisation of the vast energies available from fissile or "fusionable" materials it may be possible to disregard fuel cost entirely. This being the case, the future abundance of electricity depends upon the capital investment and the supply system load factor only.

Utilisation

In Fig. 4 capital investments of £200, £100 and £50 per kilowatt (5 per cent-7 per cent × 20 years) are plotted against load factor to indicate price per kWh. If electricity is produced at no fuel cost in a station costing £100/kW to build, its value at the station busbars would be 0·45d/kWh at the present national electricity load factor of 45-50 per cent. With an allowance of £50/kW for distribution investment, because electricity is useful only at the consumer's premises, the cost is around 0·7d/kWh.

Poor load factor implies misuse of capital, which is an indulgence the country cannot afford. The potency of this argument is illustrated by considering the extreme example of improving the national load factor from the present figure to 90 per cent; since the electricity demand doubles every ten years we could supply the kWh needed in 1968 without installing a single extra MW of generating plant. This contention is not wholly valid because of the extra "fossil" fuel required, but the urgency of improving the load factor cannot be over-stated.

Social habits of consumers and workpeople have been among the many hackneyed excuses used to avoid facing up to improving the load factor. Also the small difference between night and day generating costs with conventional plant provides insufficient incentive to frame a tariff inducement.

Should not the onus of load factor be placed firmly on the consumer by using a modified form of maximum demand tariff? If consumers purchased *kilowatt-years* instead of kilowatt-hours the supply industry's capital investment would be assured in advance. This would involve a trip set to open at the maximum demand instead of the usual integrating meter; in the event of the demand being exceeded the trip could be reset without reference to the Electricity Board since only the calibrating mechanism would be sealed. The consumer, with suitable expert advice, would consider using his allowed demand to advantage and would install a simple priority device to keep his demand at a continuous maximum. The equipment produced might equal an integrating meter in cost, but the expense of meter reading would be removed and accounting procedures would be simplified.

The precise nature of tariffs and load building is a highly specialised matter for experts in that field, but overall economic co-ordination is vital so far as national power resources are concerned. Three entities are involved in the future of electricity supply and these are the Atomic Energy Authority, the Central Electricity Generating Board and the Electricity Boards. For national well-being it is vital that the perspective is not lost because of the complexity of individual problems and the production of electricity must be geared to its utilisation.

REACTOR COURSE

A course on the control and instrumentation of reactors is to be held at the Harwell Reactor School from 6th to 11th October next. The fee for the course will be 25 guineas exclusive of accommodation. Application forms and further details can be obtained from the Principal, Reactor School, Atomic Energy Research Establishment, Harwell, Berks.

Electrical Power Convention

BUSINESS AND SOCIAL EVENTS

BRIGHTON, although rather more crowded than most other seaside resorts at this time of year, is a convenient centre for a conference such as the British Electrical Power Convention which has been taking place there this week. Hotel accommodation is ample and the civic authorities possess some useful buildings for business and social occasions.

Many of the delegates to the Convention arrived in good time to renew contacts made at previous gatherings and endeavour to fit names to familiar faces—a process made easier when the Conference badge was worn.

On Monday morning a considerable number of those attending were occupied by the electricity supply conference which, although not actually a part of the programme, is a regular feature of the Convention and a useful way of cementing relationships in the electricity supply branch. A brief account of the meeting appears elsewhere; it was greatly regretted that Sir Josiah Eccles who was to give one of the addresses was unable to be present as he is just recovering from an illness.

Monday, being a fairly free day, was, as usual, the occasion for a number of parties arranged by manufacturers as well as an opportunity for gathering at the exhibition. This year's display is on a somewhat smaller scale than usual but, apart from size, is as good as any of its predecessors, reflecting great credit upon the organisers, the British Electrical Development Association, and the exhibitors themselves. It was officially opened on Monday evening by the President, Sir George Nelson, Bt. (who was accompanied by Lady Nelson), with Mr W. S. Lewis, Chairman of the Exhibition Committee, presiding. The Mayor and Mayoress of Brighton were present.

The President with Messrs. J. I. Bernard and W. S. Lewis.

Mr and Mrs T. G. Elliott with Mr and Mrs W. L. Wray.

1.—Messrs. J. Whitfield, F. Dewhurst and J. E. Hodkinson. 2.—Messrs. A. H. Campbell, C. A. French and A. Dent. 3.—Messrs. H. F. Knell and I. M. Mackay. 4.—Mr and Mrs A. S. Oldhams. 5.—Messrs. F. G. Lamb and W. A. Crocker. 6.—Messrs. L. S. Gould, R. Cox and A. G. Milne. 7.—Messrs. J. R. Beard and A. R. Cooper. 8.—Mr and Mrs G. A. P. Jewiss with Mr D. T. Leathwood. 9.—Mr and Mrs W. E. Babb.

Introducing Sir George, Mr Lewis said that he was one of the people who believed that the Convention would not be complete without an exhibition and he called upon all delegates to give the display their fullest possible support.

In declaring the exhibition open Sir George Nelson said that the ceremony was a preliminary to the Convention proper. He took the opportunity of congratulating Lord Citrine and Mr J. S. Pickles upon their inclusion in the recent Honours List. He extended a special welcome to the British Lighting Council which was participating for the first time, and congratulated the exhibitors upon the excellence and variety of the products displayed.

The President concluded by thanking the Mayor and Corporation of Brighton for providing the site for the exhibition and for their co-operation generally. Mr Lewis presented an electric clock to the Mayoress and a travelling iron to Lady Nelson and the party then made a tour of the stands.

In the Dome on Tuesday morning, Sir George Nelson opened the proceedings by saying that the delegates were glad to be back in Brighton once more. After again congratulating Lord Citrine and Mr Pickles he expressed the Convention's regret at Sir Josiah Eccles' absence for, from the start, he had been a strong supporter of the Convention. He then introduced the Mayor (Councillor A. J. Sadler) who said that he took the return of the Convention to Brighton as an indication of satisfaction with previous arrangements. He congratulated the secretary, Mr J. W. Simpson, upon the organisation of the event and referred to the work on behalf of electricity in Brighton of Alderman E. Simms (member, South Eastern Electricity Board).

Sir George Nelson then read his presidential address and, at its conclusion, he was thanked on behalf of the delegates by Sir Christopher Hinton, Chairman of the Central Electricity Generating Board. Sir Christopher said that the President was a great industrialist who had become an almost legendary figure. That was not primarily because of his technical skill and business knowledge, but because of his imagination, foresight and courage. He was always willing to add to his work by service to industry and science, again proving that when something needed to be done it was best to go to the busiest man. His address had given them a great deal from his experience and imaginative outlook.

The meeting was then adjourned to enable Council members and delegates to tour the exhibition with the Mayor. The President's address and the Convention papers are given in abstract in later pages.

The customary luncheon arranged by the Electrical Association for Women was held at the Hotel Metropole, under the chairmanship of Viscountess Kilmuir, President of the E.A.W. After she had proposed the loyal toast, Viscountess Kilmuir proposed the toast, "Electricity for Everywoman at Home and Abroad" and said that this was a most exciting time in the electrical industry. The Conven-

10.—Messrs. B. Bonwick, J. F. Ford, G. Hamilton Cole and F. T. Allen. 11.—Mr and Mrs J. J. Thompson with Mrs H. J. Henwood. 12.—Mr and Mrs S. S. Scott and Brigadier W. G. S. Thompson.

tion exhibition showed that the industry was expanding and making great changes in all walks of life. In communications, for example, it was now an easy matter to make a telephone call to New York and, more often than not, more quickly than between towns in this country. One of the new wonders of our time was provided by the floodlighting of buildings in London, which had a beauty which would not have been believed before the days of this development. Agriculture had also derived great benefit from the increasing use of electrical appliances and techniques in this field.

In the home women showed a great interest in electricity and this applied not only in this country but all over the world. Many women from overseas looked to this country to see what new appliances and facilities they might hope to get in the future. This was particularly so in the case of under-developed countries which had for many years benefited from British inventions and developments. In conclusion, Viscountess Kilmuir said that she hoped women would realise that there were many interesting and rewarding jobs which they could take in the electrical industry and in the process they would be materially assisting in improving the lot of women all over the world.

The response was made jointly by Sir George Nelson and Sir Henry Self. Sir George said that they in the industry were proud and pleased to be able to bring women better living, and they were encouraged by the efforts of the E.A.W. in promoting a greater interest by women in the use of electricity and informing industry as to the needs and problems of women. Because the work of electrical engineers was world-wide in its scope, inevitably the wives of men in the industry were frequently left alone, and he therefore welcomed the opportunity which this convention provided for wives to see something of the work of their husbands, and have an opportunity to share their interests. Sir George was firmly of the opinion that the contribution men made to world progress through the development of electricity depended upon the help and support given them by their wives.

Sir Henry Self referred to the floodlighting of buildings and said that this technique was first started in Great Britain during the Coronation year, when the London Electricity Board played a major part in the illumination of buildings in London. Since that time many buildings of historic and architectural interest all over the country had been similarly treated. Turning to the E.A.W., he said that this fine body was first formed in 1924, since which time it had gone from strength to strength, and it would no doubt soon find that its new headquarters were too small and further space would be required. Sir Henry then appealed to all his colleagues in the supply industry to receive with approval and support the Caroline Haslett Trust.

Standing: 13.—Miss P. Thompson, Mrs S. R. Bird, Miss Mary George and Miss A. Lockhart. Seated: Miss H. Shaw and Mrs W. S. Carty. 14.—Dr. and Mrs H. G. Taylor. 15.—Mr and Mrs L. C. Penwill. 16.—Standing: Messrs. J. A. Johnson, B. A. G. MacFadden and G. N. Ham. Seated: Mr E. Badmin, Mrs MacFadden and Mr S. R. Harriman.

Sir George Nelson, supported by members of the Convention Council, reading his presidential address.

We must have such a diversity of electrical equipment in the home that the load would be spread right round the clock, and thus we would derive the full benefits of nuclear power with its requirement for a high load factor. Not nearly enough domestic appliances were in use in this country and the public must be educated to the fact that the chores of this life need not be the worry they often were.

At Tuesday afternoon's session Sir Christopher Hinton presented the first paper, "The Development of Nuclear Energy for Electricity Supply in Great Britain." The discussions on this and the other Convention papers will be reported in next week's issue.

Lady Nelson was the hostess at the ladies' tea party at the Aquarium Restaurant in the afternoon. A beauty culture demonstration was staged.

At the Corn Exchange on Tuesday evening the delegates were entertained by the Mayor and Mayoress of Brighton. The reception, at which the President and Lady Nelson assisted, was followed by dancing.

Sir Claude Gibb's paper on "The Development of Nuclear Energy for Electricity Supply Overseas" was presented and discussed at the Wednesday morning session and in the afternoon Mr H. J. Beard read his paper on "Britain's Part in Electrical Development Overseas" which, incidentally, showed the importance of the consulting engineer's rôle. Wednesday evening was left free to enable delegates to attend various parties and exchange visits.

"British Hydro-Electric Plant and World Power Requirements" was the subject of Thursday morning's paper by Messrs. J. C. Beverley, E. G. Teasdale and A. Wilmot. In the afternoon the domestic side of electricity was dealt with by Mr J. I. Bernard, Director and Secretary of E.D.A., his subject being "The Development of the Electrically-Equipped Kitchen."

The annual dinner was held at the Corn Exchange in the evening and was followed by a dance there and at the Dome. This morning is being devoted to the Electrical Forum, one of the most attractive features of the Convention, and the annual general meeting follows, this concluding the proceedings.

Top left: Mrs P. A. Bailey, Mrs C. E. Walters, Mr Walters and Mr Bailey. Top centre: Mr and Mrs J. A. Robbins. Top right: Messrs. J. S. Addyman and C. W. Cawte. Bottom left: Mr and Mrs C. L. B. White with Messrs. E. R. Stickley and A. C. Burbidge. Bottom right: Mr C. Boyes, Mr T. W. Heather, the Hon. Mrs Leslie Gamage, Mr J. Hayward and Mr Leslie Gamage.

PRESIDENTIAL ADDRESS

INTRODUCING the theme of the Convention—"Electricity and World Progress—Britain's Contribution," Sir George Nelson demonstrated the connection between the advance of electricity and progress in living standards. He estimated that by 2000 A.D. world industrial production would be over eight times the 1950 figure and electricity consumption nine times ($9{,}000 \times 10^9$ kWh), equivalent to 47 per cent of the total fuel consumption, against 21 per cent in 1950.

Sir George said that our country had made an unparalleled contribution to development in all parts of the world. The fundamentals of electrical science were laid by Faraday and in modern times a tremendous contribution had been made by the Cavendish Laboratory, Cambridge.

By and large, Britain's contribution in the field of engineering had not kept pace with the progress of fundamental science; British ideas had been more successfully developed elsewhere. That was not to say that there was not much engineering achievement of which we could be proud. He instanced the development of the steam turbine by Parsons which by way of higher steam pressures and temperatures had led to increased outputs at lower capital and running costs.

In electricity distribution, too, Britain had made important advances. The 132 kV grid system had been developed over thirty years ago, the first of its kind in the world and still the largest; it now consisted of more than 4,700 route-miles. The electricity supply system had provided a first-class laboratory for switchgear, transformers, cables, etc., and for the whole technology of electricity distribution.

Although in this country we had no great rivers and estuaries we had made important strides in the development of submarine cables. Similarly, in spite of a lack of great hydro resources, Britain was making water turbines as large as or larger than any made elsewhere, with the possible exception of Russia. It was essential that China and Russia, as possible purchasers of hydro-electric equipment, should recognise Britain's commanding position in this field.

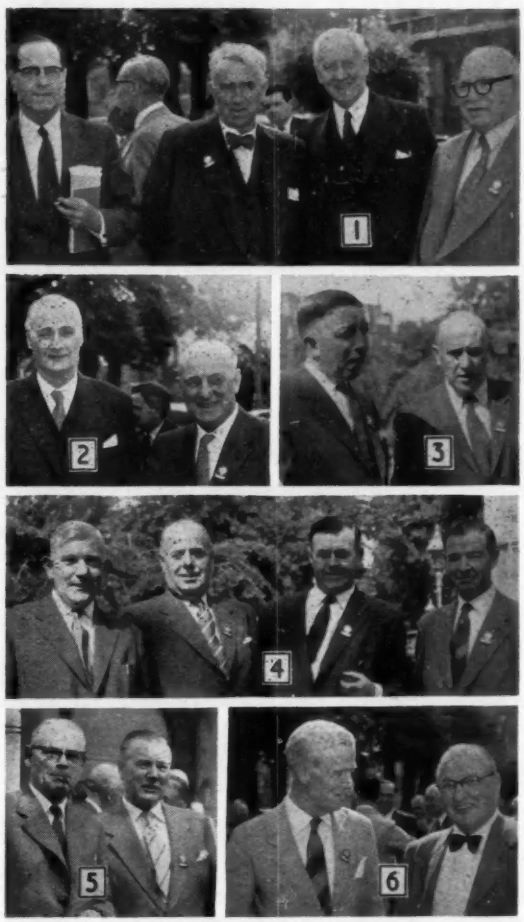
The operation of the large electric railway network in south-east England had enabled British companies to develop traction equipment to an extent not possible anywhere else in the world and foreign customers had benefited from the availability of highly-proved components and manufacturing economies based on a high level of production. Sir George also mentioned the development here of the British Railways standard diesel-electric shunting locomotive.

Impending fuel shortage had made the discovery and development of nuclear energy of the greatest importance to this country and we had been outstandingly successful in harnessing this new source of power.

Great Britain had been responsible not only for sending a large amount of machinery and equipment to overseas countries, but had also been involved in the execution of complete electrification projects. In this connection Sir George paid a tribute to British consulting engineers.

Through F.B.I. scholarships, and the efforts of many individual companies and the electricity supply industry, a constant stream of people came to this country for education and training. It was estimated that about 600 qualified electrical engineers a year returned to overseas territories to take up responsible positions. The electrical industry had done more than any other in the field of education and training; he suggested the carrying-out of an exact study by the supply and manufacturing industries to assess the optimum number of overseas students who could be accepted each year and to see whether or not some Government assistance should be sought.

In the next part of his address Sir George indicated the lines on which we must work to ensure that future progress matched past achievements. With regard to research, he said that what was required was the most careful planning and marshalling of our resources of men, materials and money—in short, the efficient management of research. So far as the electrical industry was concerned it seemed that the most spectacular future advances would come from the study of basic materials. References were made to past inventions which had awaited the production of suitable materials, to semi-conductors and ferrites, to the dependence of the harnessing of nuclear energy so largely upon metallurgy, and to advances in



1. Mr. D. G. Dodds, Mr. Thomas Johnston, Lord Citrine and Sir Hugh Mackenzie. 2. Sir Henry Self and Mr. J. S. Pickles. 3. Messrs. E. Butterworth and R. D. V. Roberts. 4. Messrs. P. Briggs, C. G. Richards, D. McFarland and W. McL. Wishart. 5. Messrs. A. Haselhurst and W. E. Gibbs. 6. Messrs. D. H. Kendon and W. S. Lewis

insulation. In the field of theoretical physics there were still great advances to be made.

One of the particular problems of engineering in the future was the provision of raw materials. One profitable line of approach was the extraction of metals from poor ores and metals might even be important by-products of the extraction of hydrogen and heavy hydrogen from sea water. Another promising advance in the engineering field was the use of electronic computers.

Studying export prospects, Sir George did not fear the growth of local manufacture in some of our best markets. He thought that this helped to engender other demands. The nature of our exports would change and we must maintain our technical progress to keep pace with these changes. He showed that our trade with Europe was expanding at a faster rate than that with the Commonwealth and in this connection the President stressed the need for this country to be associated with a European Free Trade Area. Great Britain had an essential part to play in bringing about the close integration of the European and Commonwealth economies as financier and as scientific and technical leader.

Long-term financing of export trade, particularly that in heavy capital goods, was a major problem facing British manufacturers. Competitors were offering long-term credits, which gave them a considerable advantage, and he welcomed the indication given by the Chancellor of the Exchequer that the Government might be prepared to provide guarantees or finance over longer periods than at present.

Reverting to education and training, Sir George expressed his belief that the need for the broadest and best education for leadership would demand the introduction of four-year university courses and less specialisation in the schools. Potential leaders should be chosen for character as well as book learning. We also needed trained and able technicians to relieve the top-grade men and women for more important work. Non-scientific colleagues should have some grasp of the fundamentals of science and engineering.

In conclusion the President expressed the hope that his address and the Convention papers would acquaint the delegates with the "thrilling and tremendous opportunities" which were presenting themselves.

Top: Mr. and Mrs. J. W. Simpson and Mr. H. Riley. Centre: Mr. M. J. Smith with Mr. and Mrs. Rex Bate. Bottom: Mr. and Mrs. H. D. Parsons and Mrs. J. Hall

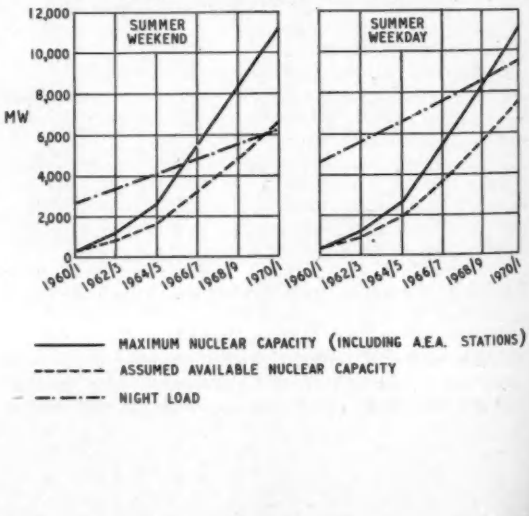
Nuclear Energy in Great Britain

Paper by Sir Christopher Hinton

IN his address on the development of nuclear energy for electricity supply in Great Britain, Sir Christopher Hinton (chairman, Central Electricity Generating Board) compared the forecasts of the 1955 White Paper with the position that recent experience had shown to be probable up to about 1970.

The original expectation of producing power from nuclear stations at 0·6d/kWh sent out (about its cost at future conventional stations) was based on obtaining a credit of 0·35d/kWh for by-product plutonium intended to enrich fuel for later reactors. More recent research had shown that under prolonged irradiation some of the plutonium was converted into non-fissionable higher isotopes, which were fairly high neutron absorbers, thus lessening its value as fuel in thermal reactors. It could, therefore, be fully used only in the much more complex fast reactors which would take time to develop commercially. Moreover, the U.S.A. had decided to make considerable quantities of enriched uranium internationally available at low cost. The plutonium credit had therefore been reduced to 0·07d/kWh. Although this loss was to some extent offset by the capital cost of nuclear stations

Loads available for nuclear generation after allowing for essential conventional generation and for pumped storage demands



being less than the initial estimates, the cost per kWh would probably be raised to 0·66d/kWh.

The White Paper had assumed, provisionally in the absence of long-term practical experience, an average fuel-element life of 3,000 MW-days per tonne of uranium, proof of which would require four years' irradiation in a power station reactor. A further assumption was that these stations would operate at a yearly load factor of 75 per cent. At present the system load factor was under 50 per cent and the minimum continuous load was about 3,000 MW. Up to 1966 this would exceed the total nuclear capacity, but later it would be less, necessitating the running of these stations at lower load factors. To compete in costs with conventional stations in the early 1970's capital costs per MW must be considerably reduced by 1966 when orders for the 1970 stations would be placed. The vital problem would lie in development of the fuel elements.

Magnesium alloy as now used for canning the fuel could not withstand temperatures much higher than 450 deg C. Zirconium was unsuitable for carbon-dioxide-cooled reactors at above 500 deg C. Beryllium could have can temperatures of 600 deg C, but it would be too expensive for use with the present form of fuel elements rated at 2 to 3 MW/tonne of fuel. For economy the specific ratings would have to be raised to 8 to 10 MW/tonne. This could be done by redesigning the fuel elements as clusters of small diameter rods, e.g. 0·3in instead of the 1in used for reactors now being built. To obviate other difficulties expensive enriched fuel in ceramic form and a life of 10,000 MW-days/tonne should be aimed at to justify the cost. Unless nuclear stations could be built to generate electricity as cheaply as conventional plants on a reducing load factor, the minimum yearly installation of 1,400 MW might fall to 300 to 400 MW to match the growth of the base load. New conventional plant would then have to be increased to 2,000 MW a year, and this reversion of policy might impose serious strains on the manufacturing industries. The only alternative would be to install nuclear plants, even if generating costs were thereby higher.

Nuclear Energy for Overseas

Paper by Sir Claude D. Gibb

IN his paper on nuclear energy for electricity supply overseas, Sir Claude D. Gibb (chairman and managing director, C. A. Parsons & Co.) was concerned mainly with the immediate and short-term future in which the fission of heavy atoms could supplement the world's resources of energy. In some countries, he pointed out, there was no economic case for nuclear power stations. Thus, in the United States coal costs would have to increase four-fold; Venezuela had apparently inexhaustible supplies of natural gas; Victoria, Australia, had 2,000 years' reserves of brown coal. On the other hand, in many regions national economies were based on oil or coal which might not last indefinitely, while in others natural resources of energy were wholly inadequate.

In view of the urgent need in Great Britain to supplement coal supplies, large-scale research and development (engaging about 10,000 scientists and engineers) was proceeding in both the Atomic Energy Authority and private industry. Industry would find the huge expenditure crippling unless orders were received for nuclear plant on a scale and at a price that would cover this expenditure. Collaboration between the A.E.A. and industry was particularly close in regard to metallurgical development, but the effects of irradiation upon materials were so unpredictable that every new alloy used required testing for long periods in a costly special reactor capable of high neutron flux. The effort required to reach the prototype design stage of a new type of reactor, after completion of basic research and feasibility study, was about 1,000 man-years and nearly as much to prepare a tender for one of the first 300 MW nuclear power stations. The chief things Great Britain could sell to highly industrialised countries were special components and results of experience in design details, in construction and in operation, which could save millions of pounds on each station built.

Messrs. G. H. O. Speaight, W. W. Makin and B. Dixon

Sir Claude Gibb

Probably the biggest single factor in capital cost reduction was reactor output. With increasing size of core, the working proportion in which fission occurred increased more rapidly than the perimeter from which neutrons could escape. Hence heat output increased as the volume of the core, whereas the containing pressure vessel and the 10ft thick biological screen increased only as the diameter. Net electrical outputs could be classified as small (up to 20 MW), medium (20 to 100 MW) and large (exceeding 100 MW). Natural uranium gas-cooled graphite-moderated units could be designed for successful operation down to 60 MW or less, though probably at unacceptably high cost.

For small electrical systems in countries where interest rates were high and load factors poor the low capital costs requisite could generally be best obtained by using fuel that had been artificially enriched in fissile U235. Enrichment would entail either the provision of diffusion plant at a cost vastly greater than that of refining the ore and the production of natural uranium metal or else dependence upon possibly one foreign source. To enrich uranium in Britain would cost much more than in the U.S.A. or the U.S.S.R. owing to the higher cost of conventional fuel here, as even a moderate size of plant would make a demand of 1,000 MW.

Four possible moderators and four cooling systems could be used with thermal reactors (Dunworth). The moderators were light water, heavy water, graphite and beryllia. The four coolants were gas, heavy water, light water and liquid metal. The ideal coolant and moderator

Left : Messrs. F. H. S. Brown and D. W. Coates. Centre : Mr. and Mrs. V. Coffee and Mr. and Mrs. A. S. Shier. Right : Mr. and Mrs. K. S. Estlin

would not absorb so many neutrons as to call for fuel enrichment. The ideal coolant would, in addition, have a high heat-transfer rate, be non-corrosive and compatible with the fuel and its cladding material, require small pumping power, not break down under irradiation and be readily obtainable at low cost. No coolant possessed all these qualities. After comparing the advantages and disadvantages of the various moderators and coolants, Sir Claude concluded that for small and medium power outputs the most promising reactor for early development would have a gas-cooled heavy water moderator fuelled with slightly enriched uranium. The choice between graphite and heavy water depended on local economics, but gas cooling offered so many advantages in regard to the steam cycle and in engineering as to be most likely to reduce capital and total generating costs, as well as permitting refuelling on load. Only a nation that was actually operating nuclear stations could provide the training essential to satisfactory and safe performance.

Britain and Overseas Development

Paper by Mr. H. J. Beard

MR. Harold J. Beard, B.A., M.I.E.E., entitled his paper " Britain's Part in Electrical Development Overseas " and in it he stressed the prominence of this country in the conception and execution of important contracts and the provision of technical aid, particularly in Commonwealth countries. To indicate the rate of electrical development he presented a table showing the 1948 and 1956 figures of electricity production. The percentage advance for the whole world was shown to have been 10·2; the figure for Great Britain was 9·5 per cent and Asia, although having the smallest per capita production, made the greatest step forward—11·9 per cent. Mr. Beard anticipated the continuance of this rate of progress.

From her experience and resources Great Britain was better able than Commonwealth countries themselves to meet their demand for technical manpower. This led the author to consider what was being done to provide sufficient numbers of qualified men and to maintain professional standards. He went on to deal with the advisory and consulting services which were available in this country. The choice of the best form of organisation to administer and operate electricity supply undertakings had been guided by British experts in a number of Commonwealth countries and the advantages of organising and planning on a national scale had been amply demonstrated here.

Problems arising in providing for continued load expansion formed another subject for impartial advice in undertakings which found it uneconomical to employ staff for the purpose. In this connection there were in Britain a number of firms of consulting engineers with practical experience in electricity supply both at home and overseas, some of them with offices in other countries. Reference was also made by the author to the benefits arising from contacts between the specialists of exporting firms and engineers overseas with particular emphasis upon the adaptation of plant to local conditions.

After saying that an enormous amount of work went into the design and programming of a large scheme, Mr. Beard showed that the need for qualified advice on the technical and economic aspects of major projects was emphasised by the International Bank for Reconstruction and Development (the " World Bank "). As an example of the World Bank's activities the Kariba hydro-electric scheme was quoted in some detail. Such contracts were the subject of international competition; in this case although the major civil and transmission line work was placed with Italian contractors, Britain's engineering industry was successful in obtaining orders for 90 per cent of the equipment for the power plant and 74 per cent of the equipment for the 330 kV transmission system.

In the next section of his paper Mr. Beard dealt with the financing of overseas contracts from the United Kingdom. He first mentioned private investment, with special reference to the Commonwealth Development Finance Co. formed by 91 business concerns and the Bank of England. He estimated that since 1952 the net private long-term capital flow from the United Kingdom to the sterling Commonwealth had averaged over £100 million a year. Next, Government finance received attention and this was put at about £67 million in 1956. Altogether, overseas investment during 1953-56 ran at nearly £200 million a year.

Turning to the World Bank, the author presented a table showing that loans for electrical development from this source had totalled £310 million up to 30th June, 1957. Added to this were the contributions of the Technical Assistance Administration of the United Nations; the Colombo Plan for South East Asia; the Export-Import Bank (United States), which authorised credits for generating equipment to the value of $45 million in 1956-57; and the American Development Loan Fund.

Mr. Beard then analysed in some detail the United Kingdom's electrical export trade, amounting in 1957 to £279 million, or 22 per cent of our electrical production,

compared with 20 per cent for Western Germany and 6 per cent for the United States. Particulars were included in the paper of some notable British export orders.

Saying that the British electrical industry was always willing to meet all reasonable demands made on it, the author refuted charges of inflexibility and unwillingness to co-operate which, he said, were more characteristic of non-British than British firms. To maintain their position in the export markets manufacturers had to be prepared to tender for almost all jobs which came along. Mr. Beard urged the necessity for clear and comprehensive specifications from purchasers. He also stressed the importance of after-sales service with appropriate stocks of spares.

Hitherto, we had been able to try out in this country types of plant required overseas, but now tenders for larger or more advanced equipment were asked for. Mr. Beard thought that it might sometimes be necessary to proceed with the development of new designs or new types of equipment in advance of the home demand for them. The electricity supply authorities here rendered great assistance to the manufacturing industry by installing and proving equipment on their systems; by anticipating future requirements where it was possible to do so; and by arranging for overseas engineers to inspect their installations.

Finally, the author considered the matter of standards. He commended the work of the British Standards Institution and referred to the activities of the International Electrotechnical Commission and the International Organisation for Standardisation. He also touched upon the subjects of model conditions of contract for export trade and international conditions of contract for electrical and mechanical equipment.

Attached to the paper were appendices giving world power data and details of recent loans made by the World Bank for electrical development.

Hydro-Electric Plant

Paper by Messrs. J. C. Beverley, E. G. Teasdale and A. Wilmot

EXAMINING the contribution made by British hydro-electric plant to world power requirements, Messrs. J. C. Beverley, E. G. Teasdale and A. Wilmot (English Electric Co.) expressed confidence that for many years the development of water power would hold its own with other power sources. Probable increases in price of coal and oil would favour such a tendency. In countries in course of development imports of fossil fuels imposed a heavy burden on balance of payments and it might be considered worth while to install hydro plant even if the cost of power were greater than for thermal plant. With the coming of base-load nuclear power stations, water turbines, especially in combination with pumped storage, would provide the best means of dealing with peak loads. About 45 per cent of the world production of electricity in 1950 was by water power, but even in countries well endowed in this way the proportion of the potential harnessed was still relatively small. The free world would require 8,000 MW of new h.e. plant this year and 10,500 MW three years hence, which would be accompanied by corresponding transmission equipment. To obtain essential data before incurring the high capital expenditure involved (mainly on civil engineering), consulting engineers had to make lengthy investigations and it might take 15 years or more to put a plant into service.

Mr. J. C. Beverley

Mr. E. G. Teasdale

Mr. A. Wilmot

Britain had been associated, either by manufacture or by design of water turbines and/or alternators, with one-third of the largest projects abroad, leading particulars of which with other notable instances are given in the accompanying table.

REPRESENTATIVE EXAMPLES OF MODERN WATER TURBINES, DESIGNED, SUPPLIED OR UNDER CONSTRUCTION BY BRITISH MANUFACTURERS

Name	Country	Type	No. of units	Output in b.h.p. per unit	Net head feet	Speed r.p.m.	Overall runner diameter
							ft in
Chute-des-Passes	Canada	Francis	5	200,000(a)	548	200	13 8
Bersimis I	Canada	Francis	4	175,000(c)	875	277	11 11
Kariba	Rhodesia	Francis	6	140,000	280	167	13 6
Snowy TI	Australia	Francis	4	134,500	1,095	375	9 3
Priest Rapids	United States	Kaplan	10	131,000	84	85·7	23 8
Belesar	Spain	Francis	3	105,000	436	214	10 4
Ffestiniog (Pumped Storage)	Wales	Francis	4	110,000(a)	970	428	8 5
Eildon	Australia	Francis	2	82,100	235	150	12 5
Rihand	India	Francis	5	77,000	225	150	12 11
St. Lawrence	Canada	Propeller(b)	16	75,000	81	94·7	21 0
Los Peares	Spain	Francis	3	73,800	306	214	9 5
Cabril	Portugal	Francis	2	73,000	384	214	10 9
Table Rock	United States	Francis	4	68,000	190	128·6	14 0
Ponte Coberta	Brazil	Francis	2	62,000	115	115·4	15 10
Salto de Castro	Spain	Francis	2	59,000	125	107	15 11
Hirakud	India	Kaplan	2	52,000	87	150	15 9
Sir Adam Beck No. 2	Canada	Deriaz	6	45,000	83	92·3	22 4
(Pumped storage.	These units operate in reverse as 55,000 h.p., 4,600 cusec, 75 feet head pumps)						
Hirfanli	Turkey	Francis	3	44,000	197	187	10 11
Finlarig	Scotland	Impulse	1	42,000	1,250	375	9 8
Tungatinah	Tasmania	Francis	5	35,000	935	600	5 10
Atiamuri	New Zealand	Francis	3	30,000	81	125	13 7
St. Fillans	Scotland	Francis	1	30,000	785	600	5 1
Invergarry	Scotland	Kaplan	1	28,000	167	250	9 5
Waipapa	New Zealand	Kaplan	3	24,000	53	125	16 0
Owens Falls	Uganda	Kaplan	8	21,000	62	150	13 7

(a) Largest turbines of their kind in the world. (b) Largest total capacity. (c) Largest units yet in operation.

Within the last ten years the maximum head in general use for Francis turbines (formerly 800ft) and for Kaplan turbines (formerly 100ft) had been doubled. A 28,000 h.p., 250 r.p.m. Kaplan unit had been installed in the Invergarry power station (Scotland) to operate under a head of 187ft. A new turbine, as installed in the Sir Adam Beck No. 2 station (Canada), called the "Deriaz" after its inventor (the chief designer of a British manufacturer), was of the Francis type with movable blades. It overcame the hydraulic limitations of the Kaplan design and could be operated at heads up to 600ft.

British water-turbine designs were based almost entirely on welded-steel components, except for the shafts—a practice which other countries were now following.

Where h.e. output was fed into a large interconnected system, the governors might have to take into account such factors as tie-line power and water level and flow in addition to frequency and gate setting. Mechanical control was tardy and the best method entailed the use of an electro-hydraulic governor, a British design of which was proving notably successful.

Alternator sizes had been forced upward not only by output but also by requirements regarding line-charging capacity, short-circuit ratio and transient reactance. If figures sometimes specified for these factors were reduced, kVA outputs could be appreciably higher for a given size of machine. Increasing use was being made of grain-oriented steel for stator laminations, though its advantages would not be nearly so great as they would be for transformers.

In addition to the very large units referred to above and in the table, about 9,300 small water turbines (up to about 6,000 kW) of an aggregate capacity of well over 300,000 h.p. had been built in this country; approximately half of this horse-power had been exported.

1. Mr. A. W. H. Bradstreet, Mr. and Mrs. A. N. Irens and Mr. H. C. Timewell. 2. Mr. and Mrs. T. Counter and Mr. and Mrs. J. S. Harrison. 3. Mr. and Mrs. R. E. Wacher. 4. Mr. and Mrs. C. T. Melling

Electricity in the Kitchen

Paper by Mr. J. I. Bernard

"THE Development of the Electrically Equipped Kitchen" was the subject of the paper given by Mr. J. I. Bernard (director and secretary, British Electrical Development Association). In the first part of his paper he described electrical appliances in some detail, stating that with their use the planning of new kitchens was simplified and existing kitchens, however badly planned, could be equipped on modern lines. There were, he said, over 3 million users of electricity for cooking, and, given reasonable freedom from financial restrictions, the number should increase rapidly in the future. Mention was also made of improved materials and methods of manufacture and how valuable they had proved in securing the better performances now available from boiling plates. Grill boilers and the cooker ovens were dealt with and also the introduction of automatic timer controls. Over 90 per cent of the cooker inquiries made at an E.D.A. stand at a recent exhibition were for fully automatic models, said Mr. Bernard.

Mr. J. I. Bernard

Dealing with refrigerators, he said that the slow growth in their use in Great Britain might seem to the outside observer to be almost a national disgrace, but the reasons for the relative backwardness in this country were not far to seek, the most obvious being purchase tax and the credit squeeze. That the design of British-made refrigerators was as good as any and better than most was proved by the large proportion exported.

Hot water needs next received attention and various systems and equipment were described. This was followed by references to the progress made in the manufacture of home laundry appliances, a development which had been brought about to a very large extent by the rise in commercial laundry charges. The increase in the number of washing machines from 2 per cent of householders in 1947 to 23 per cent in 1957 had been probably the most noteworthy development in the domestic appliance business, said the author. He also dealt with the subject of clothes drying, observing that the term "dryer" as applied to the spin dryer, the most recent addition to this range of home laundry appliances, might be somewhat misleading. It could be more accurately applied to other appliances, such as drying cabinets and the newer tumbler dryers.

The question of whether extract fans should be fitted in all-electric kitchens was, he thought, rather a debatable point, as there was no problem of combustion with electric cookers. He advocated their use, however, because of their ability to dispose of cooking smells and also, if much clothes drying was carried out indoors, to dispose of the moisture. In addition to the smaller electric cooking appliances such as kettles, toasters and frying pans, there were many other portable appliances for which provision should be made.

All over this country, Mr. Bernard said, there were a great number of kitchens badly in need of rearrangement and re-equipment. Experience with the E.D.A. Kitchen

Planning Service had shown that an efficient labour-saving layout was quite impossible in a high proportion of these sub-standard kitchens and it was not worth while spending large sums of money on structural alterations. Fortunately there was a remedy and in practice such kitchens would benefit by re-equipment with modern electrical appliances. With the addition of a few counter tops and cupboards, the kitchens could be made much easier to work in, the possibilities being greater than might be supposed. There were, however, two important requirements; first, the type and size of each must be carefully selected to meet the conditions of each case, and secondly, the appliances must be placed as nearly as possible in a proper relation to each other and other essential items. Typical arrangements were described.

Some suitable form of heating should always be provided in the kitchen, he said, and for the larger kitchen, with sufficient unoccupied wall space, he thought that an inset reflector fire was satisfactory. For smaller kitchens overhead reflector fires were quite cheerful but undoubtedly the most satisfactory and comfortable form of heating was electric floor warming. This, however, could only be adopted in new houses. In existing kitchens there was much to be said for the fan type air warmer.

Electric lighting, especially the fluorescent lamp, was of the greatest value in making a gloomy kitchen more attractive. Another important factor was the need for adequate wiring. Nowhere, he said, was this more apparent than in the kitchen. A good arrangement was to provide socket-outlets of the 13 A type, some at waist height round the room for portable appliances, and others just above the skirting for heaters, washing machines and other larger appliances.

Mr. J. Johnson Smith, Mrs. J. C. Milne, Mr. E. W. Walker and Mr. J. C. Milne

Mr. Bernard concluded his review of kitchen design with some comparisons with other countries. The country most prominently associated with luxury kitchens was the United States, but apart from the greater number of appliances, which were generally on the lines of those available in this country, American kitchens showed no advantage over, or any great difference from, those in this country. He thought that we had little or nothing to learn from abroad, except that there were no taxes or restrictions on the sale of electrical appliances.

ELECTRICITY-GAS CO-OPERATION

VIEWS OF THE E.P.E.A.

IN evidence prepared for submission to the Government Committee now examining possible co-operation between Electricity and Gas Boards, the Electrical Power Engineers' Association rejects the case for co-operation on the grounds that it would weaken the competitive efficiency of the two industries.

As the Association sees it, the fundamental objection to the joint working of the two industries is that it is inconsistent with the spirit and intention of the Acts of Parliament which brought the industries into national ownership. The Acts provided for continuance of the industries' economic independence by the statutory stipulation that each must pay its way, taking one year with another, on a commercial basis. To impose on the Boards—even in a small way—arrangements from outside which they would not wish to have if left to their own free choice seems to the Association to be mistaken in policy and dangerous in principle. There may or may not be convincing arguments for integrating all fuel industries under one control, but not in favour of singling out two of these industries and compelling them to merge a few of their activities which relate directly to the consumer.

Apart from the logic of having competing and separate electricity and gas industries, the Association considers that the present system is in the practical interests of consumers and is also greatly beneficial to the morale and keen outlook of staff, particularly those engaged on development work. It emphasises that the whole industry is in a state of continuous technical evolution. The point is made that showrooms, service centres, advertising and publicity are really essential intermediate links in a long chain which ties the consumer to the power source. To remove some links from that chain and interpose an artificial junction with a different and rival industry would be to weaken the sense of purpose which means so much to those who have made electricity supply their career.

On one particular aspect—load factor improvement, the need for which will become more pressing than ever with the operation of expensive nuclear plant—it is felt that the co-ordination of consumer services would have an inhibiting effect on the drive to build up appropriate loads.

The Association concludes its general case against joint working by drawing attention to the unsettling effects of reorganisation, threatened or actual. It feels the time has come to call a halt to externally imposed change so that the industry can be left to evolve according to its own commercial needs.

Commenting on specific forms of co-operation, the Association says that meter reading is generally outside the direct experience of its members, but it is felt that the gains from joint meter reading are likely to prove more theoretical than real. On accounting methods and billing arrangements, the view is expressed that the span of management control has already become too wide and needs to be reduced; joint accountancy arrangements are likely to aggravate rather than modify unwieldy organisation. Most showrooms are only just adequate for their purpose, and combination of the two services would be

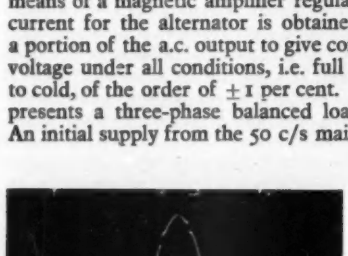
likely to involve a large building extension programme. As consumer appliances must be demonstrated, gas supplies would have to be provided in electricity showrooms. On publicity and advertising, the Association firmly believes that a nationally-owned but commercial enterprise, in an age when advertising and publicity has become so much a part of our daily life, has the same right and obligation to put its case to the public as any other business. In its view, the electricity supply industry needs to spend more and not less on advertising itself.

After pointing out that the Public Utilities Street Works Act already requires an undertaking to notify others before starting on a particular job, so that in that sense co-operation already exists between Gas and Electricity Boards, the Association refers to labour relations. In electricity supply, as in the gas industry, there is a closely knit system of collective bargaining involving complicated agreements and system of payment and the Association says that the possibilities of troubled labour relations with combined working would seem to be boundless.

High-Stability Motor Alternator

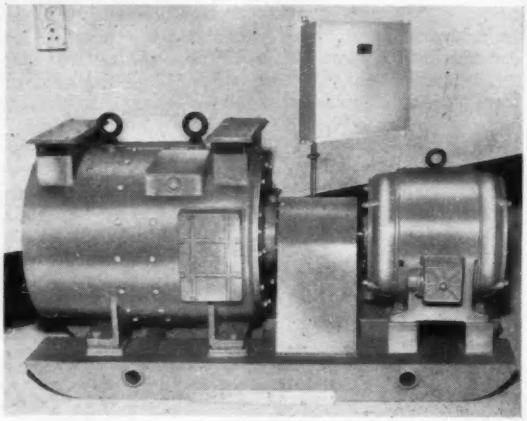
WHEN radio, radar and other electronic apparatus is being tested and calibrated *in situ* in a modern aircraft it is necessary to have an external power supply which has a high order of stability, meeting the same close tolerances as that of the power generation system fitted to the aircraft. The same high standard of supply is necessary for maintaining the radar equipment in servicing centres before re-installation in the aircraft. To meet the demand for generating plant of this kind W. Mackie & Co., Ltd., Palace Engineering Works, 129-133, Lambeth Road, London, S.E.1, have introduced a range of 200 V three-phase 400 c/s motor alternator sets with ratings from 500 VA to 20 kVA which have a very low output impedance at fundamental and harmonic frequencies. This enables them to maintain a substantially sinusoidal waveform when feeding electronic equipment having a high proportion of rectifier loading. The application of this equipment is not necessarily restricted to the aircraft industry, as many other industries frequently require power supplies with this sort of specification.

Each generating set consists of a suitable driving motor coupled to a sixteen-pole 3,000 r.p.m. rotating armature alternator by means of a flexible coupling, the two machines being mounted on a common skid-type steel bed-plate. The 400 c/s output voltage is controlled by means of a magnetic amplifier regulator and the d.c. field current for the alternator is obtained by rectification of a portion of the a.c. output to give control over the output voltage under all conditions, i.e. full load to no load, hot to cold, of the order of ±1 per cent. The control system presents a three-phase balanced load to the alternator. An initial supply from the 50 c/s mains is used to provide voltage build-up and sensing is obtained from a three-phase full-wave bridge rectifier.



Waveform with 5·6 A simulated radar load comprising 800 W square wave + 125 W triangular wave + 1,040 W resistive wave

It has been found advantageous to utilise one basic design of alternator with suitable windings to cover varied requirements from 2·5 kVA to 20 kVA outputs, the performance remaining well within the specified tolerances. Motors of suitable capacity are coupled to the alternator as mentioned above.



Mackie high-stability 400 c/s motor alternator set

Tests carried out at the Royal Radar Establishment, Malvern, on a set rated at 3 kVA show that under the worst possible switching conditions the peak voltage variation is within ±2·14 per cent and, in less than 50 millisec, is within ±2 per cent. A final steady level is reached in 250 millisec. Modulation does not exceed 0·06 per cent. With regard to waveform, the maximum form factor error recorded under the worst possible conditions with rectifier loading was −0·4 per cent; the maximum peak factor error was +1·13 per cent.

A Broader View

IN the autumn of 1956 the Central Electricity Authority arranged a series of lectures on the history and philosophy of science and technology for senior staff of the industry from London and the Home Counties. The object of this course was to suggest to senior staff one way of achieving a breadth of outlook and a wider appreciation of the immediate job by a broad study of its setting in history and thought. These eight lectures, which were delivered by Sir Henry Self, Professor H. Dingle, Dr. P. Dunsheath and Professor Douglas McKie, are now available in a printed form from the Education and Training Branch of the Electricity Council, Winsley Street, London, W.1, price 9s. As a further contribution to the course Sir Henry Self has written and published privately a supplementary paper dealing with some implications of modern science (price 1s 6d).

VIEWS on the NEWS

By REFLECTOR

IN my opinion among the best of the serious programmes on the B.B.C.'s sound services are the recordings of the debates of the Fifty-One Society of Manchester. Unfortunately these are only occasionally relayed by the London transmitters and it was therefore against a considerable background of atmospherics that I listened to the broadcast from the north last week of the last of the present series of debates. In this, Mr. Andrew Cooper (of the Central Electricity Generating Board) most ably led a discussion on the changing pattern of industrial leadership. Mr. Cooper summed up his own views on leadership with the story of the philosopher who was continually playing a single note on his one-string fiddle. This he repeated day in day out for years and years until his wife, who was a very patient woman, could stand it no longer. She remarked that she had noticed that other philosophers had four strings on their fiddles and ran their fingers up and down to produce a series of notes, with more pleasing results. "But," her husband replied, "they are still searching for their note; I have found mine." The moral, as Mr. Cooper pointed out, is that a good leader is one who both recognises that each man has his own note, and knows how to combine these notes in harmony.

* * *

Sir John Hacking in his address to the Electrical Industries Club last week recalled that as recently as 1921 there were in London fifty different systems of electricity supply, operating at twenty-four voltages and ten frequencies. It says much for those concerned that integration has been carried out with so little disturbance although, of course, it has taken a long time. Sir John also explained why, in the eighties of last century, Dr. S. Z. de Ferranti adopted the seemingly strange frequency of 83⅓ c/s. In those days a.c. was thought of in terms of complete "reversals" per minute. In the case of the Grosvenor Gallery alternators this figure was 10,000. Divided by two and by sixty the frequency clearly works out at the odd figure of 83⅓ cycles per second.

* * *

It is not so long since there was a great deal of fuss about the detrimental effect of modern concrete lamp standards on the architectural charms of a street of Victorian houses in Paddington. The other day I saw an example where the boot could be said to be on the other foot, and the old detracted from the new. On a traffic island in front of the main entrance to the new office block of Evershed & Vignoles there is (judging from an advertisement which appeared in *The Times* on the day of the opening) a venerable lamp post of a pattern which continues to adorn far too many London streets—it even looks as though it is still operated by gas. Could it, I wonder, have been retained for sentimental reasons, like the private lamp posts in front of certain establishments in the Strand? Perhaps it was erected in 1895, the year of the firm's foundation. Or is it just that this company which has so skilfully mastered the techniques of controlling many industrial processes has been less successful in influencing the operations of the local council? If the occupants of old houses can object to modern lighting, I feel that an electrical manufacturer who graces his district with a fine modern building has a good case for insisting that the surrounding lighting be brought up to date, or at least into the present century.

* * *

Electric floor heating installations have for some time now been giving satisfactory service in houses and flats, as well as schools, commercial premises and the like; a prototype system in a medical clinic at Motherwell dates back to 1944. I was surprised, therefore, to read that Twickenham Housing Committee has rejected this form of heating for a block of flats because, according to one councillor, they were told that it was still in an experimental stage. When the subject was debated by the Town Council an attempt was made by Councillor J. E. Woodward to get the Committee's recommendation in favour of oil heating referred back. He contended that the information before the Committee was incomplete and possibly misleading. The costs were given as 8s 6d a week per flat for oil and 14s 6d for floor heating whereas the figures should have been 13s 6d and 12s 6d respectively. The chairman of the Housing Committee admitted that the revised figures were as stated by Councillor Woodward but on an even vote (18 for and 18 against) the reference back was declared not carried.

* * *

The *Electrical Review* of 22nd June, 1888, reported an action brought by a hotel proprietor against the Liverpool Electric Supply Co. for an injunction to restrain the company from working the machines at their supply station in Tithebarn Street in such a manner as to annoy him. The plaintiff said that the vibration set up in his premises by two steam-engine-driven 40 h.p. generators had had very adverse effects upon his family's health. The judge, after visiting the plaintiff's premises, said:—

> "He considered the plaintiff was entitled to an injunction, but such an order would be a great hardship upon the defendants owing to various circumstances. He considered remedy by damages would be the proper course to adopt. He would, therefore, either grant an inquiry for damages or, if agreeable to both sides, he would himself assess the damages. Both counsel agreed to the latter course, and his honour said he thought the justice of the case would be met by fixing the damages at £100, and ordering defendants to pay costs. With regard to the machinery of the defendant company, he must say that he never saw a better working plant for carrying on such a business than theirs was. Had the machinery been not so well constructed there would undoubtedly have been a far greater injury than at present existed."

It looks as though the company carried on. Did it have to pay periodical damages?

C.I.G.R.E. Proceedings

DEVELOPMENTS IN A.C. AND D.C. TRANSMISSION

PAPERS on high-voltage transmission occupied the attention of delegates at the concluding technical sessions of this year's Conférence Internationale des Grands Réseaux Electriques (C.I.G.R.E.) in Paris, the earlier proceedings of which were summarised in our last issue.

H.V. Transmission (A.C.)

Recent and expected developments at voltages in excess of 220 kV were presented by P. Sporn (U.S.A.) as follows: France: conversion (1957) of 275 miles of double-circuit 225 kV to single-circuit 400 kV (two conductors per phase); ultimate total at 400 kV to be 1,790 miles. Sweden: new 433-mile line, 380 kV (1956); total of 1,910 circuit-miles scheduled for commissioning this year; 310 miles planned with three conductors (instead of present two) per phase; voltages of 500 to 650 kV considered to be not justifiable economically. Great Britain: 612 miles of 275 kV circuits in service (October, 1957), of which 142 miles were temporarily operated at 132 kV; 1,700 line-miles to be in service by 1960. U.S.A.: 1,520 line-miles in operation at 345 kV (one conductor per phase). U.S.S.R.: 1,060 miles single-circuit 400 kV lines (during 1956) with three conductors per phase; total by 1960 3,100 miles; conversion of some 400 kV circuits to 500 kV and design of 600-750 kV lines under consideration. Germany: 210 miles at 380 kV during 1957 (four conductors per phase); also 100 miles for 380 kV operated temporarily at 220 kV. Canada: several hundred miles at 345 kV in service (two conductors per phase). Australia: 330 kV system now under construction, to be extended to 800 route-miles by 1965. Finland: 240 miles of 380 kV in service at 220 kV; additional 335 miles at 380 kV to be completed in 1960. Japan: 350 miles at 275 kV in service; also a 154 kV double-circuit line converted to 275 kV (two conductors per phase). In the U.S.A. frequency of lightning flashover on 345 kV lines considerably exceeded expectations. In Great Britain the initial fault rate for 275 kV lines was somewhat higher than had been expected.

Mr. P. W. Cash

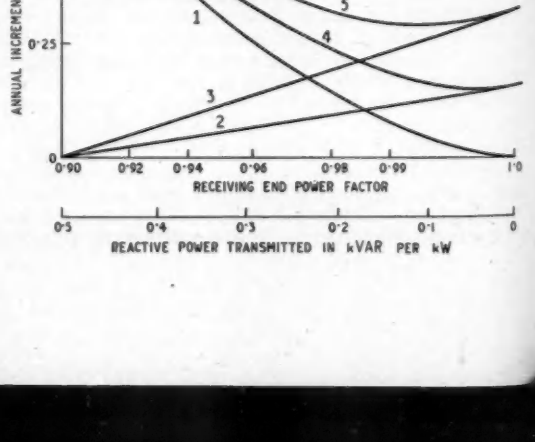
Mr. A. Chorlton

Discussing insulation co-ordination, I. Herlitz and S. Rusck (Sweden) said that the earlier international tendency to provide ample margins to secure reliability had been replaced by more detailed studies of what insulation was really required, since at very high voltages insulation formed a major part of the costs. The possibilities of reducing insulation seemed to rest upon effective earthing of the neutral and considerably improved lightning protection. To-day a factor of 0·75 (instead of 0·8) of the service voltage as the highest voltage to earth during earth faults was regarded as attainable. A lightning protection ratio of about 2·9 was being considered as against the former limit of 3·6. With lower insulation levels, stresses imposed by switching surges (previously well below those due to lightning) would again come to the fore. Thermal deterioration of insulation hardly influenced electric strength and electric failure resulted from physical disintegration.

Three aspects of main transmission development in England and Wales were covered by P. W. Cash and A. Chorlton (C.E.G.B.). The first related to the latest plans for the British 275 kV system, the second to means of coping with reactive power supply; the third outlined the steps taken to ensure recovery of induction motors after system voltage disturbance. The primary purposes up to 1960 were to provide for adequate national interconnection and, secondarily, for the bulk transmission of energy from the expanding coalfields in the Midlands (where half the coal required for electricity generation was now produced) to coal-importing areas in the south and north-west, thus saving transport.

From 1961 to 1965 coal would be supplemented by oil equivalent to six million tons in the last year and by nuclear power equivalent to 15 million tons out of a total of 65 million tons then needed, the amount of coal itself remaining approximately as at present (44 million tons). During that period 11,500 MW (sent out) of new generating plant would be installed (bringing the total capacity to 38,774 MW in service in 1965). This would include 5,000 MW of nuclear plant in ten stations situated on coasts or estuaries in areas deficient in coal production, tending to reduce the amount of electricity transmitted from the Midlands. The nuclear stations would generally be connected directly to the 275 kV network. Most of the new coal-fired stations would contain generating units of approximately 200, 300 and 600 MW. The 275 kV

Fig. 3.—Reactive power transmission costs. (1) Cost incurred in transmission; (2) cost incurred by shunt capacitor; (3) cost incurred by synchronous condenser; (4) total cost with shunt capacitor; (5) total cost with synchronous condenser



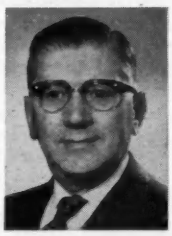
Dr. H. G. Taylor (director, E.R.A.), Mr. R. A. McMahon (secretary, British National Committee, C.I.G.R.E.), Miss H. Todd (E.R.A.) and Mr. E. W. Golding (E.R.A.)

Mr. P. C. Phillips (Yorkshire Electricity Board), Mrs. Stowell, Mr. R. W. Flux (Bruce Peebles) and Mr. P. d'E. Stowell (Merseyside and North Wales Electricity Board)

system would then perform a third function of increasing magnitude, namely the transmission of the whole output of certain generating stations over long or short distances to points on the 132 kV system.

Reactive demand by consumers averaged 0·4 kVAr/kW at maximum active power demand and by transmission and distribution systems to 0·1 kVAr. This 0·5 kVAr was supplied almost entirely by the generating plant operating at an average power factor of 0·9 lagging but it could contribute up to 0·6 kVAr, thus leaving ample margin to regulate reactive transfers over generating station interconnections. In future increasing transmission distances and other factors would call for reactive compensation, as shown by the case in Fig. 3.

Mr. P. F. Gunning



Mr. M. Kaufmann

The programme of re-equipment of eight grid control centres and 300 generation and/or transmission stations embarked on in 1950 and completed last month was described in detail by P. F. Gunning and M. Kaufmann (Central Electricity Generating Board). The original remote indication, telephone and telemetering systems installed in the 1930's were no longer equal to the expansion of the grid and had been replaced by a standardised readily extensible system which had been undertaken by the supply authority in conjunction with the Automatic Telephone & Electric Co., the General Electric Co., and Standard Telephones & Cables with the co-operation of the G.P.O. (see *Electrical Review*, 30th May and 6th June). The new system catered also for the control of unattended substations.

Earlier experience had proved the many advantages of using ordinary lines rented from and maintained by the Post Office on a basis of priority treatment for faults on power circuits. Among these advantages was the ability to use for normal distances inexpensive d.c. signalling equipment; the overall cost even with tone signalling was considerably less than that for pilot cable or cable line carrier. The lines would transmit 2,400 c/s and could therefore simultaneously transmit speech, telemetering and indications. Phantom d.c. earth return signals were employed for intermittent traffic and ten-way time-division multiplex 50-band transmission for high-density telemetering traffic. Where d.c. signalling was not feasible, 300 c/s with by-pass speech filters was employed. Distant stations were in groups of four or fewer, as satellites to a parent station, which would have a direct line to the control centre.

Lightning and Surges

The report of the study committee on lightning and surges (K. Berger) summarised results obtained in 14 European laboratories in the measurement of breakdown voltages. The curve for the probability of breakdown was measured with the normal 1/50 wave and its characteristic was determined by applying waves with rising amplitude and front steepness. Whereas conformity of results using sphere gaps was sufficient, this was not so for rod gaps and still less for measurements within the wavefront. Mention was made of a lightning-flash counter, developed by R. H. Golde (E.R.A.) and now commercially available, which it was hoped would furnish more accurate information on severity of storms than the isoceraunic level now used.

Information from a number of countries was co-ordinated in a special report by R. H. Golde. Records obtained during two years at three 132 kV grid substations equipped with bulk-oil circuit-breakers by means of an automatic oscillograph and analysed statistically by E. L. White and M. P. Reece (E.R.A.) showed the highest relative over-voltage to have been 2·65 at the terminals of a transformer during de-energising, the probability of occurrence being once in ten years. When the relative over-voltage from this cause exceeded 2·3, it was the result of a final single-current chop in the last phase to clear. Below that value, it was usually recorded on a phase that was not arcing and was due to high-frequency oscillatory voltages induced by single or repetitive current chopping on the arcing phase. There was no evidence of progressive voltage build-up to very high levels, although arcing usually persisted for at least six half-cycles. Relative over-voltages due to switching were noticeably lower on plant other than transformers.

Introducing a discussion of experience in a number of countries on interference with telephones and radio from

Mr. R. H. Golde

Mr. E. L. White

Mr. M. P. Reece

Left : Messrs. R. E. Martin (Central Electricity Research), W. W. Smith (C.E.G.B.) and E. V. Hardaker (C.E.G.B.). Centre : Messrs. G. Lyon (Merz & McLellan), K. Boothroyd (Pilkington Bros.) and A. R. Pollard ("Electrical Review"). Right : Messrs. H. E. Forrest (Hackbridge & Hewittic), M. G. Cronin (Electricity Supply Board, Ireland) and S. E. Goodall (Henley's)

power circuits, L. Gosland (E.R.A.) referred to the correlation of measured and calculated earth-fault currents. Data from five countries showed agreement in regard to artificial faults, but in 2,000 naturally occurring faults (measured usually by high-speed ammeters or oscillographs with memory feature) the actual value averaged only 50 per cent of that calculated for the heaviest fault current, owing perhaps to the improbability of co-existence of factors responsible for the worst conditions. Study of the relationship between such faults and protective devices against induced voltages on neighbouring telephone lines might permit a more realistic assessment of the necessity, merits and economics of the latter. Interference from 50 c/s single-phase railways had caused few problems, probably because telephone lines were cabled when railways were electrified. Direct danger from shocks or incendic sparking due to induction from h.v. overhead lines was extremely improbable as the capacitance of any insulated metallic objects handled was very small; hazards were mainly those arising from involuntary movements. Measurements of interference produced by insulators must now cover television frequencies. Particular attention should be paid to interference from lines operated below 150 kV, since above that figure the effects of corona predominated. Unusual and persistent interference with radio might indicate an incipient line fault. In Great Britain the great majority of complaints related to interference with television originating in lines at 11 kV or less and very few to lines at 132 kV and above.

Mr. L. Gosland

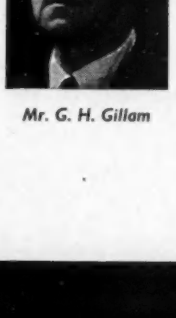
Mr. F. J. Lane

D.C. Transmission

Among the papers not discussed at the technical sessions was one concerning the present stage of development of d.c. transmission in Britain, Germany, Japan, Russia and Sweden which was prepared by F. J. Lane (Preece, Cardew & Rider) and S. Smedspelt (Sweden). The most ambitious project under consideration appeared to be a proposal to transport 3,000 MW from Siberian waterfalls to European Russia. For testing its feasibility a ±400 kV d.c., 750 MW line was to be built between Stalingrad and Donbass.

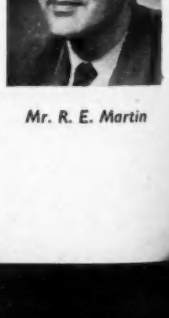
For interconnecting two larger a.c. networks, d.c. eliminated problems of synchronous operation, as illustrated by the ±100 kV, 100 MW cable to be used for linking the English and French systems. A connection between the southern and northern islands of New Zealand was under consideration.

Swedish opinion was that d.c. transmission was comparable with a.c. in reliability. The Gotland Island connection was to be supplemented within the next five years, using a new type of valve (one anode instead of two as at present) operating at 75 kV and 200 A, and larger convertors. Owing to the regulating equipment for the valves, over-voltages on the cable were lower than expected so the testing voltage (425 kV) for the new cable could be the same as for the existing one, notwithstanding the raising of the working voltage by 50 per cent. Lead-sheathed paper-insulated cables with reduced insulation and polyethylene cables without lead sheathing had been laid in the Baltic for service tests in the d.c. transmission circuit. With a view to simplifying control equipment, the transmission of regulating pulses between the two convertor stations via carrier frequency by the power cable instead of via the radio link was being investigated with encouraging results. Results of a Russian study of the comparative costs of a.c. and d.c. overhead line transmission agreed substantially with a 1956 C.I.G.R.E. estimate, and indicated equality at about 700 km for 750 MW and 4,000 million kWh/annum. A Japanese investigation, however, suggested an appreciably shorter distance as economic owing, no doubt, to differences in costs and local conditions. Competitive possibilities of d.c. would frequently depend upon the use of the earth as a return conductor, subject to permissible leakage currents and experience with cathodic protection (to avoid corrosion). Regarding submarine cables, the important question was the magnitude of magnetic disturbances that maritime authorities would permit. Internal voltages set up in a line were appreciably lower with d.c. than with a.c., but more information was required about the behaviour of d.c. insulation before determining insulation levels. Tests on insulators on d.c. overhead lines had not been very favourable, as the wet flashover voltage appeared to correspond only to the r.m.s. values of a.c. Harmonics



Mr. G. H. Gillam

Dr. J. S. Forrest



Mr. R. E. Martin

produced by rectifiers seemed to be directly associated with grid control, but wave traps in the form of damped capacitor banks provided an economic solution if disturbances should be troublesome.

Other papers presented but not discussed included the report of the chairman of the committee on bare conductors (O. D. Zetterholm), who referred to the adoption in Great Britain of an everyday stress value equal to 20 per cent of the ultimate loading when dampers were used. Mention was made of a Belgian appliance designed to control conductor temperature so as to avoid ageing of materials and to prevent dangerous surges. In a progress report on insulators G. H. Gillam (Taylor, Tunnicliff) said that seismographic records produced by M. Gion (France) showed that the heavier vibrations usually occurred at night. This finding was confirmed by J. S. Forrest who, with R. E. Martin also of the Central Electricity Research Laboratories, contributed a report on laboratory methods of measuring radio interference from h.v. insulators. The committee could find no evidence connecting insulator failures with vibration. Supersonic tests were held to be useful when applied to insulators of simple shapes, but it was doubted whether they could detect slight porosity.

Social Events and Visits

The more arduous side of the Conference was relieved by the excellence of the arrangements made by the French hosts for the entertainment of the visitors. Perhaps the high spot of the social events was the traditional garden party given by the French Committee at the Cercle Interallié. This party was a great success, despite the fact that it had to be held indoors because of a sudden thunderstorm and heavy downpour of rain. Another equally enjoyable event was the ballet performance presented at the Théâtre National du Palais de Chaillot by the Ballet of the Marquis de Cuevas. In addition numerous railway and coach excursions had been organised.

Visits of technical interest during the Conference included those to the research and testing centre of Electricité de France at Fontenay, the Central Laboratory of Electrical Industries where the national French standards are kept, the Plessis-Gassot 380 kV substation, and the 500 MW Porcheville power station. There were also visits after the Conference to the Rhine and Rhône valleys to see some of France's modern hydro-electric works.

Mrs. Wilton, Mr. G. S. Wilton (South of Scotland Electricity Board), Mr. F. H. Merrill (I.C.I.) and Mrs. Merrill

Mr. R. F. Baldwin (Wakefield-Dick Industrial Oils), Mr. E. J. Whitcher (London Electricity Board), Mrs. P. Gossling and Mr. W. Wilde (C.E.G.B.)

NEWS FROM INDIA

From our New Delhi Correspondent

THE Sarda hydro-electric project at Khatima, in Uttar Pradesh, is about to be written off as a recurring liability, according to reports circulating in New Delhi, the State Electricity Department having refused to take it over from the company which was responsible for the supply and erection of the three 3,800 kW turbines and generators. The company's staff has been running the power station since 1956 when it went on commercial load.

Besides alleged structural defects of which the Department has complained, the plant is threatened by the high silicon content of nearly 1,000 tons of sand passing through the machines every twenty-four hours. Corroded by silicon, the life of the machines, it is believed, is shortened to about two years, necessitating reconditioning every third year instead of every eighth year. The prohibitive maintenance costs make the whole project uneconomic.

The power house has had a chequered history. Soon after the first two machines had been put on commercial load in February, 1955, a cable broke down, putting the power house out of service until August when some more cables were damaged at the time of the commissioning of the third machine. When the cables were repaired the machines developed leakage trouble. The machines went out of action until March, 1956, but during October that year the canal feeding the station was choked up owing to trouble at the Sarda headworks. A Government Inquiry Committee estimates the loss from delayed commissioning, etc., at about £250,000. The capital cost of the project is nearly £6,000,000. The Committee in its report says: "It would appear that over ten years after placing the order and even two years after the first machine was produced the company is still experimenting in order to find out a satisfactory way of dealing with the problem of contamination of the bearing lubricating system by water."

The manufacturers have refuted the charge that the plant was defective or the erectors had been negligent. They ascribe the present trouble to inadequate water analysis provided by the Electricity Department to the manufacturers. According to the analysis, the maximum concentration of suspended solids was as high as 14 grams per litre, but since the high content of silicon in the sand was never properly assessed by the Electricity Department, the information was inadequate from the manufacturers' point of view. The company maintains that a better alloy than that used in the manufacture of the turbines "has yet to be discovered."

Automatic Assembly of Printed Circuits

FASTER PRODUCTION OF TELEVISION RECEIVERS

IN the Ferguson 406T 17in table model television receiver, which is now in production at the Enfield factories of Thorn Electrical Industries, Ltd., all the wiring except for the controls and tuner unit is contained on printed circuit boards. In addition to the obvious savings obtained by reducing the amount of hand wiring, production has been considerably speeded up by the introduction of automatic machines for assembling the smaller components on to the printed circuit boards. By these and other improvements in its production methods the company has doubled its potential output of television receivers during the past year.

The company has also adopted a new type of disc tuner and a new cabinet finish which has substantial advantages both during manufacture and in use.

900 Boards an Hour

The greatest advances have been made in the assembly of components on the printed circuit boards, and the main unit has an output of 900 assembled boards an hour. With the exception of the silk-screen printing, the boards are themselves processed by automatic methods at the rate of two million square inches a week. The main automatic assembly unit, as can be seen from Fig. 1, consists of two guide rails along which the printed circuit boards are drawn, and a series of adjustable heads which insert the components or their leads into the appropriate holes in the boards. The unit is 80ft long and at present has 75 inserter heads. The heads are electronically controlled and are operated by compressed air at a pressure of 100 lb/sq in. The components are fed to the heads on bandoliers, each bandolier drum holding approximately 2,500 components. With all the drums full, this number of boards can be assembled without human intervention. Because of the fine limits to which the unit works, the components are specially supplied to factory specification.

An electronically-controlled braking mechanism is arranged to stop the machine when any inserter head exhausts its supply of components. Each head is also interlocked so that it will only operate when there is a board in position. The time cycle mechanism—also electronically controlled—is regulated by the speed of the heads. The position of the heads can be quickly adjusted to cater for different circuits and boards of various sizes.

Two printed circuit boards are employed in the Ferguson 406T receiver. During its six-minute journey through the assembly unit each intermediate frequency board is fitted with 69 components, which include resistors, terminal pins, valve holders and the jumper wires used to link parts of the circuit. The power boards are fitted with 47 components.

At present the larger components, such as capacitors, transformers and valves, are not fitted on the automatic unit, but are inserted by hand on an adjacent assembly line. At the end of this (Fig. 2) a solder-resistant fluid is printed on to the under-side of the boards to mask all but the points where the solder is intended to adhere. The boards are next carried at a predetermined speed along a "solder wave" (which can be seen immediately behind the first operator in Fig. 2), where they pass first over a stream of flux, pumped up through a narrow slit, then over a line of radiant heating elements, and finally over a stream of molten solder.

The circuit boards now pass to the test section, where they are carried round on a continuously-circulating conveyor fitted with six-tier trays. Each tray denotes a different test, and when this has been completed the circuit board is replaced on one of the passing trays but at the next test level. In theory, a circuit which shows a persistent fault will go round and round on the conveyor for ever, but it cannot leave the factory.

Fig. 1.—The main automatic printed circuit assembly unit has an output of 900 assembled boards an hour. The bandolier drums on the inserter heads each holds 2,500 components

The use of printed circuits has enabled the final assembly of the 406T receiver to be carried out on a single production line instead of on three lines as would previously have been required. The components are fed to the operators by box trays carried on an overhead conveyor, and all component and other leads are cut in advance to the exact length so that no trimming has to be done on the chassis, and there is no danger of loose wires remaining in the set.

The new disc tuner is a 13-channel selector which is smaller, lighter and more compact than its predecessor. The rotor carries 52 different

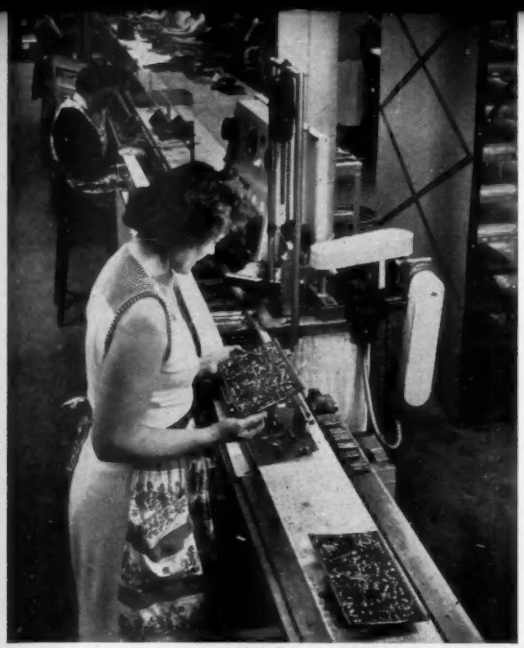


Fig. 2.—After the larger components have been inserted by hand, the boards pass over a "solder wave," where a continuous flow of solder seals the circuit connections

coils, 39 of which are accurate in every dimension to within one-thousandth of an inch, and they are positioned with equal accuracy. The production of these coils at the required speed and precision is made possible, first, by a specially designed automatic coil-winding machine capable of producing the coils for many thousands of tuners a week. It occupies only 36 sq ft of floor space compared with the 300 sq ft that would normally be required. Secondly, by using pre-formed components (e.g. capacitors with their leads trimmed to the right length within 0·001in) the assembly line procedure is greatly simplified and operators are able to make the fullest use of sensitive apparatus with greater speed, accuracy and consistency than has hitherto been possible. The rotor is a plastic moulding made to a tolerance of 0·005in across the diameter and when the coils are in position all the 104 joints are automatically soldered in five seconds. Since incorrect pressure on the spring contacts could cause picture failure or distortion, every one of the contacts has to be set and gauged to a pressure of between 50 and 70 grammes/sq in.

The "Esterpol" finish, which is now being used on Ferguson receivers, is a synthetic resin lacquer which is sprayed on in one application and then finished by sand-belting and polishing. It is not affected by solvents, corrosives and household detergents and a cigarette can be stubbed out on it without leaving a mark.

N.A.L.G.O. CONFERENCE

From a Correspondent

THAT the members of the National and Local Government Officers are concerned not only with their pay but also with the efficient operation of the services in which they are employed was manifest at the annual conference at Douglas (I.O.M.) last week.

The president, Mr. A. E. Odell, indeed spoke plainly to this effect in his opening address. "If Britain is to survive in the modern world," he maintained, "she must adapt her old industries to modern ways, adopt more efficient techniques, streamline and speed up her productive and administrative processes."

To these objectives they attached one condition, Mr. Odell remarked: when reorganisation, intended to improve technical standards, took place, those affected must be treated humanely, and this meant above all a co-operative policy between the authority and the trade unions. One other warning word was that such changes were welcomed when they were for the benefit of the service, but not when they resulted from reorganisation "for its own sake"; they must be on their guard against constant and fruitless tinkering with their services.

Integration of Fuel Services

Another indication that N.A.L.G.O. members were conscious not only of their rights but of their duties was contained in a notice of motion, carried without dissent, calling for a Royal Commission to examine the whole field of power developments and to produce a plan for the most efficient integration of all fuel services. N.A.L.G.O. had given evidence to the Weir Committee, said Mr. L. G. Moser, the Association's organisation officer for electricity staffs, and delegates praised the terms of the evidence as calculated to counter uninformed public agitation for unpractical forms of co-operation between the electricity and gas industries.

Mr. Moser reviewed the staffing position as it had developed since last year's conference. Salaries had been improved from March, 1957; the lower general clerical scale had been got rid of; there had been upgrading of many station clerks; overtime conditions had been improved; and the long negotiations over managerial and higher executive grades had come to a conclusion in an agreement dated back to November, 1956. Delegates commented on the six points by which the retail index of prices had risen since the last agreement came into force, but, although a motion was presented to conference calling for new claims in all fields where none was already under consideration, there was general agreement that the timing of any fresh claims must be left to the leadership.

Strike Action Rejected

The natural wish of conference delegates to try to win compensation for the rise in prices was balanced by their recognition of the chilliness of the economic climate: "Never has the timing of a claim been more important," said Mr. Moser. Several proposals were brought forward with the intention of strengthening of N.A.L.G.O.'s negotiating position. The use of the strike weapon was considered again, but for the second time it was rejected. Its effectiveness would be blunted by N.A.L.G.O.'s own apathetic members and by the hardening of the public attitude to strikes, was the opinion of one speaker which seemed to be shared by most delegates.

A suggestion which won more widespread support was one for imposing on all employees of the services covered by N.A.L.G.O. the requirement to belong to a trade union.

This form of closed shop would be new policy for the Association and it has previously been opposed outright from the platform: this time the Executive Council's spokesman said it would be a pity to reject the motion for it drew attention to the natural bitterness of trade unionists against those who enjoyed the benefits and contributed neither money nor help to the cause. The motion was accordingly referred to the Executive Council who will examine its merits and practicability.

The third major proposal for enhancing N.A.L.G.O.'s power was to ally it to the Trades Union Congress. Debate on the subject was complicated, but three significant trends can be distinguished. First, that the conference was unwilling, despite its unchallengeable authority to determine the Association's policy, to decide then and there on the issue. Second, just as the Executive Council had given no lead to the conference, so the conference would not advise the membership. And third, though it was decided to take a ballot of the members, a new condition was imposed which makes it improbable that even a favourable vote will be put into effect: for that to be done, conference resolved, there must be an absolute majority of the whole membership—not merely of those voting. This condition was imposed on a card vote of 110,011 to 103,547. It would have the effect, said one cynical delegate, that the matter would be decided not by the majority of those who voted but by the unascertained views of those who did not trouble to record their votes. They would be assumed to have voted "No."

COLOUR TELEVISION TESTS

THE B.B.C. has issued a report, B.B.C. Engineering Division Monograph No. 18 ("The B.B.C Colour Television Tests: An Appraisal of Results," price 5s), on the series of colour television tests carried out by its staff, in co-operation with the radio industry, up to the spring of 1957. It describes the results as promising, though further experimental work will be needed to resolve outstanding problems concerning mainly the design of equipment. The B.B.C. has formed the opinion that the system used (an adaptation of the American N.T.S.C. system) is capable of giving acceptable results. Since these tests were completed, a further series has been carried out. The results of these are now being analysed.

The field trials on which the B.B.C. now reports extended over a period of seventeen months. So far as reception of the colour picture is concerned, the B.B.C.'s verdict is that the colour pictures produced by the N.T.S.C. system as adapted to 405 lines, with the picture sources and display tubes that are at present available, are satisfactory. The problem of registration with the three-tube colour camera requires attention and certain features of the display tube could with advantage be improved, but the technical performance of the system is adequate for a satisfactory colour television service in the frequency bands at present in use. The tests radiated from Crystal Palace from November, 1956, to April, 1957, included live studio performances, film and slides. Of the observers, 89 per cent regarded the reception of the live scenes as satisfactory. The 35 mm film was regarded as satisfactory by 100 per cent of the observers, and the 16 mm film by 93 per cent, and the slides by 98 per cent.

The quality of ordinary black and white television, when received on a colour television set, was found to be generally satisfactory. The quality of the colour transmissions, when received in black and white on ordinary television sets, was also carefully examined; 94 per cent of technical observers found the pictures completely acceptable.

The results of the tests have been communicated to the Television Advisory Committee which has the task of advising the Postmaster-General on the whole field of television. The results have also been sent to the C.C.I.R. (International Radio Consultative Committee) which has just met in Moscow to consider colour television.

The B.B.C. will carry out further experimental transmissions from time to time. It is pointed out that there are many other problems to be solved: for example, the production of a reasonably-priced colour receiving set and agreement on the future standards to be applied to the development of television in the United Kingdom. The decision whether or not there is to be a public service of colour television, and if so the system to be used, rests with the Postmaster-General.

In 1954, Marconi's Wireless Telegraph Co., Ltd., first introduced a modified N.T.S.C. system to this country, when a successful demonstration of various possible systems of compatible colour television was given at Marconi House, London. Marconi's supplied much of the major transmission equipment which has been used by the B.B.C. in its experimental colour broadcasts, including the 3-tube colour cameras, the associated camera control equipment, the complete signal encoding equipment and all the accessories which go to make a complete colour camera channel, including colour monitors. A considerable quantity of colour test equipment was also supplied. Marconi transmitters, including the high-power transmitters at the Crystal Palace, were used for the majority of the experimental broadcasts.

The modified N.T.S.C. system has also been developed by Marconi's for medical use. A vehicle containing over two tons of colour television equipment was formally handed over recently by the company to Smith Kline & French Laboratories, Ltd.—the first unit of its kind in the country. The equipment will be used to televise surgical operations over a closed circuit at medical conventions throughout the country.

Reactor Control and Safety

IN a paper presented to the Institution of Mechanical Engineers, Messrs. R. Parr (A.E.I.-John Thompson Nuclear Energy Co.) and D. V. Wordsworth (A.E.R.E., Harwell) describe a method of analysis of nuclear reactor dynamics based on theoretical results and experimental measurements obtained with B.E.P.O.

The method, originally developed for a graphite-moderated, gas-cooled solid-fuel-element reactor, is regarded as capable of development to suit other types. Possibly dangerous situations are generally associated with excessive temperatures at some point in a reactor system. Prediction of the possibility of the uranium fuel reaching too high a temperature, the prevention of boiling in water-cooled systems and of excessive thermal stresses and temperature-dependent chemical reactions are examples of the use of the analysis. Equations are derived which indicate the dependence of reactor power dynamics on fundamental design parameters, reactivity and delayed neutrons for static-fuel thermal and fast reactors and for circulating-fuel thermal reactors.

Maximum difference between theory and experiment is 10 per cent at maximum power during a transient resulting from a sudden increase in reactivity of 200×10^{-5} which the authors consider a fair agreement in view of known approximations and errors in measuring techniques.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. O. H. Buckingham, until recently sales director of the Hotpoint Electric Appliance Co., Ltd., retired on 10th June after completing forty-six years' service in the A.E.I. group of companies, twenty-six of which have been with the Hotpoint Co. Mr. Buckingham was educated at Dulwich College and joined the British Thomson-Houston Co., Ltd., as a drawing office apprentice in 1912. At the outbreak of the 1914-18 war he joined the Royal Warwickshire Regiment. He was commissioned in 1915 in the Leicestershire Regiment and attained the rank of major.

Rejoining the B.T.H. Co. in 1919, he became an assistant in the Chief Engineer's Department under Mr. Sporborg and, in 1927, was appointed personal assistant to the works manager, Mr. A. P. Young. Mr. Buckingham joined the Hotpoint Co. as general manager in 1932 and was appointed to the board in 1945. Mr.

Mr. O. H. Buckingham (left) with Mr. R. Craig Wood at a presentation to mark his retirement

Buckingham is shown in the accompanying picture with Mr. R. Craig Wood (managing director) during an informal presentation at Crown House.

Dr. W. A. Baker, research manager of the British Non-Ferrous Metals Research Association, is leaving at the end of July to join the Northern Aluminium Co., Ltd. He joined the B.N.F.M.R.A. in 1935, became senior metallurgist in 1946 and research manager in 1950. To fill the vacancy arising from his resignation, the Association has appointed **Mr. A. Cibula** and **Mr. R. Eborall**—respectively heads of the Melting and Casting and of the General Metallurgy Sections—as research superintendents, jointly responsible to the director for the work of the Research Department.

Mr. G. T. Shears, M.I.E.E., who deals with the economics of nuclear power production on page 1152 of this issue, is deputy commercial manager of the United Kingdom Atomic Energy Authority. He was born in London in 1914 and educated at the Grocers' Company's School, and later at the Administrative Staff College. From 1933 to 1945 he was with the Northmet Power Co., working in the company's mains and traction departments and power stations. He joined the Central Electricity Board in 1946, serving in the South East England District, and upon nationalisation of the electricity supply industry he became senior assistant engineer with the Eastern Electricity Board. Then, in 1949, he went over to the Eastern Division of the C.E.A. as operations liaison engineer. In 1955 he was appointed senior engineer, reactor operation, with the Atomic Energy Authority and he took up his present position last year.

Mr. G. T. Shears

Mr. I. Sclar, chairman and managing director of James Scott & Co. (Electrical Engineers), Ltd., has been elected for a second term as president of the Electrical Contractors' Association for Scotland. Mr. Sclar is also chairman of the Joint Apprenticeship Council for the Electrical Contracting Industry in Scotland.

Mr. W. Sampson, M.I.Mech.E., M.I.Mar.E., has retired as manager of the Steam Division of Foster Wheeler, Ltd., but remains a director of the company. He has been succeeded as manager of the Steam Division by **Mr. C. E. H. Verity,** O.B.E., M.I.Mech.E., M.I.E.E., M.I.Mar.E., who is also a director of the company. **Mr. R. L. J. Hayden,** B.Sc., A.C.G.I., continues as assistant manager of the Steam Division, **Mr. L. K. D. Wood,** M.B.E., M.I.Mar.E., has been appointed marine manager and **Mr. L. J. Culver,** B.Sc., A.C.G.I., A.M.I.Mech.E., A.M.I.Mar.E., at present head of marine boiler design, becomes assistant marine manager.

Mr. J. O. Sewell has been appointed assistant general manager of the British Divisions of the Yale & Towne Manufacturing Co. In addition to his duties as assistant general manager of the British Lock and Hardware Division and British Materials Handling Division, Mr. Sewell will also retain his title of comptroller.

An "open day" was held on 7th June at the Enfield works of **Belling & Lee, Ltd.,** when 1,700 visitors saw demonstrations of work and activities by the various departments. The function was attended by the Mayor of Enfield, Councillor F. C. Cuneen, J.P., the headmaster of Enfield Technical College and other local personalities.

Mr. D. T. L. Rettie, M.A., marketing director of the Hotpoint Electric Appliance Co., Ltd., was elected to the Council of the Incorporated Society of British Advertisers on 11th June and will represent the Domestic Equipment and Services Trade Group.

The new chairman of the Association of Supervising Electrical Engineers is **Mr. J. H. K. Pendry,** of Fulham, London, S.W. There is an interesting connection between his also being hon. treasurer of the A.S.E.E. Exhibition Co. and the Earls Court buildings, for he was the first electrical engineer there and re-designed the remote controls for the 3-11 kV electrode boilers, then the largest in the country. Mr. Pendry has been a member of the A.S.E.E. for 21 years. He is assistant consulting engineer to Debenham's, Ltd.

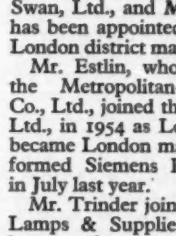
Mr. J. H. K. Pendry

Mr. J. J. McManus informs us that he has relinquished his appointment with Everett, Edgcumbe & Co., Ltd.

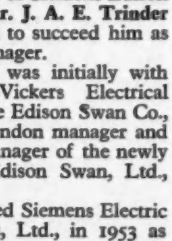
Mr. K. S. Estlin has been appointed cable sales manager of Siemens Edison Swan, Ltd., and **Mr. J. A. E. Trinder** has been appointed to succeed him as London district manager.

Mr. Estlin, who was initially with the Metropolitan-Vickers Electrical Co., Ltd., joined the Edison Swan Co., Ltd., in 1954 as London manager and became London manager of the newly formed Siemens Edison Swan, Ltd., in July last year.

Mr. Trinder joined Siemens Electric Lamps & Supplies, Ltd., in 1953 as home sales manager, subsequently



Mr. K. S. Estlin



Mr. J. A. E. Trinder

taking over the appointment of London area manager of Siemens Brothers & Co., Ltd. He has served as assistant London manager of the newly formed Siemens Edison Swan, Ltd., since July last year.

Following the appointment of **Mr. R. R. Belbin,** M.Inst.F., as station superintendent, Tilbury generating station, **Mr. J. H. W. Cope,** deputy station superintendent, Goldington generating station, has been appointed station superintendent, Goldington, as from 1st June. Mr. Cope will also be responsible for Bedford generating station. He entered the electricity supply industry in 1924 with the former Northmet Power Co. at Brimsdown. He was appointed maintenance engineer (electrical) at Rye House generating station in 1951, and deputy station superintendent at Goldington when the station was commissioned in 1955.

Mr. J. H. W. Cope

Mr. H. N. Pantlin has been appointed technical manager of the Electrical Appliance Division of Philips Electrical, Ltd. Formerly he was for 12 years with the English Electric Co., Ltd., latterly as chief engineer, Domestic Appliance Division.

Mr. H. N. Pantlin

At a meeting of the Council of the Public Transport Association held in London on 12th June, **Mr. T. R. Williams** was re-elected as chairman of the Council of the Association for the ensuing year. **Mr. A. F. R. Carling** and **Mr. R. E. Chisnell** were also re-elected vice-chairmen.

The Association of Supervising Electrical Engineers has admitted its first lady member, as a student-graduate. She is **Miss R. Aldridge,** daughter of the Association's vice-chairman, Mr. C. G. Aldridge. Miss Aldridge, now studying physics and mathematics at Bromley Grammar School, hopes to go to St. Andrew's University to read for an electrical engineering degree.

Mr. H. S. Beach retired on 30th May, having been employed by Siemens Brothers & Co., Ltd., later Siemens Edison Swan, Ltd., for over forty-four years. Mr. Beach joined Siemens Brothers in 1914 as a wireless operator and after some years' service at sea opened the Cardiff marine office in 1919. Ten years later he was appointed to the Newcastle marine office and after twenty-two years he opened the Southampton marine office and became consultant to that branch a year ago. On 28th May the commercial director, Mr. W. G. Patterson, presented Mr. Beach with a cheque subscribed to by directors and staff at Woolwich and the provincial marine offices.

The annual golf tournament of the **London Electric Wire Co. & Smiths, Ltd.,** held in conjunction with its sales conference, took place recently on the links of the Roehampton Club and was won by Mr. J. R. Cox, technical director, with Mr. A. Calley, London branch manager, as runner-up. Mrs. E. L. Wildy, wife of the chairman and managing director, presented the prizes. At the official dinner held the previous evening at the Waldorf Hotel the inter-branch sales trophy was presented to Mr. J. K. Gellatly, the Glasgow branch manager.

Miss Elizabeth Giles, who won the Elizabeth Sloane Chesser Cup last year, has now been transferred from the south-west area of the Jackson Electric Stove Co., Ltd., to area demonstrator covering the Midlands and East Midlands Electricity Board area. She is attached to the Midlands area office of the company at Daimler House, Paradise Street, Birmingham.

Over 2,000 employees attended the annual sports day held at Enfield on 7th June by the **Ferguson/Thorn Sports and Social Club.** Personnel from Spennymoor, Enfield, Tottenham, Merthyr Tydfil, Newhaven, Judd Street and Edmonton participated. The prizes were presented by Mr. A. J. Ford.

Nearly 200 members of the **Electrical Association for Women** were present at the South-Eastern Area Conference held at Richmond on 5th June, and most of the 19 Branches in the Area were represented. Guests were welcomed by the Mayor, accompanied by the Mayoress. The luncheon was held under the chairmanship of Mrs. Stracey-Cheel, president of Thames Valley, the hostess Branch. Education was the conference theme, and the speakers were Miss Mary George (E.A.W. Director), County Alderman J. H. Knaggs, J.P. (chairman, Education Committee, Middlesex County Council), and Miss Marion Binks (holder of the 13th Caroline Haslett Trust Travelling Exhibition). Guests included Mrs. Knaggs, Mr. W. H. Dunkley (South Eastern divisional controller, C.E.G.B.) and Mrs. Dunkley, and Mr. D. C. Thomson (district manager, South Eastern Electricity Board).

Mr. D. N. Brittain, manager of the Repair Department of the Midland Electric Installation Co., Ltd., has been appointed an executive director of the company. **Mr. K. Ratcliffe** has been appointed sales manager.

Mr. P. H. Jackson, M.C., has been appointed home sales manager of the Lancashire Dynamo Group which he has served for more than twenty years. He joined the Trafford Park Works of Lancashire Dynamo & Crypto, Ltd., in 1936 as an assistant engineer in the Service Department, after initial training with British Electrical Repairs, Ltd. During the war he served with the Royal Artillery in France and with the Royal Horse Artillery and Combined Operations in the Middle East. He returned to Trafford Park in March, 1946, and after a period in the Estimating Department he took up duties in the company's Manchester sales office. In 1951 he joined the London office staff where he specialised in the supply of equipment to power stations. When the Lancashire Dynamo Group's new selling arrangements came into operation in July last year, Mr. Jackson was appointed an assistant sales manager of the group.

Mr. P. H. Jackson

At the annual general meeting of the Federation of Wholesale Organisations held on 2nd June, **Mr. C. Horton,**

Sir George Nelson (president) opening the British Electrical Power Convention Exhibition on Monday evening *(see page 1155)*

At the E.A.W. luncheon at Brighton on Tuesday (see page 1156): Viscountess Kilmuir (president) and Sir George Nelson are in the centre

secretary of the Radio Wholesalers' Federation and Motor Factors' Association, was elected president. The members of the Council include **Mr. P. B. Etheridge,** secretary of the Electrical Wholesalers' Federation.

Mr. D. Forge, recently southern sales manager with Sunbeam Electric, Ltd., has joined Hurseal, Ltd., as sales manager of the new electrical appliances division. Mr. Forge will be responsible for marketing a special range of Hurseal's oil-filled radiators and the new oil-filled "Towel - Rad." He will also be concerned with the launching of a new electric convector and extending the market for the washable bedsheet and the airing cupboard heater.

Mr. D. Forge

Mr. Leslie Gamage, chairman and managing director of the General Electric Co., Ltd., has retired from the presidency of the Institute of Export, which he has held for fifteen years. The Institute is arranging a luncheon in his honour for 2nd July.

Mr. D. Kinnell, sales manager of Dorman & Smith, Ltd., and D.S. Plugs, Ltd., has been appointed to the boards of both companies. Mr. Kinnell, who joined the group in 1948, was export manager for seven years and has been sales manager since 1955.

Mr. D. Kinnell

The London area golf meeting of the **Electrical Industries National Golf Championship** will be held on Thursday, 10th July, at Denham Golf Club, Bucks. Those wishing to participate can obtain golf cards from Mr. L. H. Welch, London Electricity Board, 46, New Broad Street, London, E.C.2.

OBITUARY

Mr. E. A. Gatehouse.—We regret to report the death at his home at Horley, Surrey, on 14th June, of Mr. Ernest Arthur Gatehouse, A.M.I.C.E., A.M.I.E.E.; he was seventy-five. Mr. Gatehouse received his training with the British Thomson-Houston Co., Ltd., and served with that company for some years before joining the *Electrical Review* as a director; he retained that position until about 1930. He was the son of Mr. T. E. Gatehouse, who was for some time technical editor of this journal and a director of the former proprietors, Alabaster, Gatehouse & Kemp, Ltd.

Baron Ove Thott.—The death occurred on 4th June at the age of seventy-two of Baron Ove Thott, M.I.Mech.E., chairman of Boving & Co., Ltd. Baron Thott was Swedish by birth and received his education at the Technical High School in Stockholm and practical training as an engineer at the works of A.S.E.A. He came to London in 1910 and joined the then small firm of Boving & Co. The remainder of his life was devoted to the interests of the company of which he was for many years managing director and latterly chairman. Baron Thott took great interest in Swedish affairs in London and was a member and past president of the Swedish Society of Engineers.

Mr. R. C. Bulgin.—The death occurred on 6th June, after a long illness, of Mr. Reginald Charles Bulgin, director of A. F. Bulgin & Co., Ltd. Mr. Bulgin, who was fifty-two, had been with the company since its inception in 1923, and had been in charge of the Purchasing Department for many years.

Mrs. Grace Brown Macleod, chairman and director of William Y. McAdam, Ltd., electrical engineers, Hamilton, died on 12th June. The business was founded by her first husband, the late Mr. W. Y. McAdam, and she took it over on his death in 1946. It will be continued by Mr. and Mrs. J. Graham, her son-in-law and daughter.

Mr. John Mawdsley Brooke, M.I.Mar.E., managing director of the Venner group of companies, died on 12th June at the age of fifty-six. Mr. Brooke was educated at Oundle School and received his training with the Sunbeam Motor Car Co. He was works manager of the Rover Co. and later general manager of Rootes Securities before joining Venner's.

The late Mr. J. M. Brooke

WILLS

Mr. K. H. Nalder, a director of Nalder Bros. & Thompson, Ltd., and legal adviser to the General Electric Co., Ltd., who died on 27th February last, left £32,126 gross (£29,914 net).

Lt.-Col. F. W. Foster, M.C., A.M.I.E.E., former consultant to George Ellison, Ltd., and for 20 years manager of their Manchester and district sales office, who died on 16th January last, left £2,957 gross (£2,890 net).

Mr. A. E. Hudd, inventor of the automatic train control system on the London-Tilbury-Southend line, who died on 31st January last, left £1,079 gross (£927 net).

Mr. J. B. McGillivray, chairman and founder of Aurora Lamps, Ltd., and a director of James Howden & Co., Ltd., who died on 2nd June last, left personal estate in England and Scotland valued at £2,209.

Sir Alexander Gibb, G.B.E., C.B., F.R.S., M.I.C.E., the consulting engineer, who died on 21st January last, left £79,191 gross (£77,606 net).

Mr. J. Williams, north-eastern area manager of the General Electric Co., Ltd., who died on 13th January last, left £14,141 gross (£13,912 net).

Mr. H. Hanson, late deputy chairman of Turner and Newall, Ltd., for many years chairman of Turners Asbestos Cement Co., Ltd., who died on 5th February last, left £78,599 gross (£63,092 net).

Mr. A. R. Leivers, F.C.A., former chairman of Gent & Co., Ltd., and Smart & Brown, Ltd., who died on 1st March last, left £128,571 gross (£126,204 net).

Protection Against Corrosion

THE Joint Committee for the Co-ordination of the Cathodic Protection of Buried Structures has issued a 31-page pamphlet reviewing recent progress in this field. The Committee, formed in December, 1953, is composed of representatives of major underground services in Britain in collaboration with the Department of Scientific and Industrial Research and other research associations. Eight of the 14 representatives are corporate members of the Institution of Electrical Engineers, including the chairman, Mr. W. T. J. Atkins and the hon. secretary, Mr. J. H. Gosden, 24-30, Holborn, London, E.C.1.

The main function of the Committee and of its technical panel (chairman, Dr. F. Wormwell of the D.S.I.R.) is to examine the possibility of harmful interference with nearby metallic objects due to stray electric currents in the soil set up by cathodic protection and to determine the value of bonding for reducing high positive charges, subject to the limitations set out, and other remedial measures. Research is being carried out at Cambridge University to obtain data regarding the effects of corrosion rates. In the meantime, provisional permissible values have been agreed to by the bodies concerned. Other matters under consideration include the techniques of testing, economics, safety, protective coverings and ground bed materials which later may provide the basis for a national code of practice by the British Standards Institution. The technical panel also maintains a register of known cathodic-protection installations, details of 500 of which are available, ranging from small lead-covered cables to 48in diameter water pipes.

Electrochemical principles of corrosion, resulting from the greater chemical stability of its products than the metal itself, are summarised; only through the agency of ground waters is buried metal attacked. In Britain the worst corrosion of iron and steel occurs in anaerobic waterlogged clay soils of less than 2,000 ohm-cm resistivity which are neutral in reaction and free of air or uncombined oxygen. Well-washed gravels, lime soils and sands on high grounds seldom give serious trouble. The object of cathodic protection is described as being to ensure that the whole of the protected metal structure is the cathode in a galvanic cell. The simplest method is to make the anode a separate " sacrificial " renewable electrode which provides current in the course of its own corrosion, such as magnesium alloyed with aluminium or zinc, which is more reactive chemically than any point on the structure. Sacrificial anodes are unsuitable for soils above 3,000 ohm-cm.

An alternative is to use current derived from an independent source of direct current with anodes of scrap iron or graphite to reduce the cost of renewal. A single installation may give protection to 80 miles of well-coated pipeline, but for bare pipeline one may be required each mile. Capital and running costs are usually less than for the sacrificial anode system. Another method, sometimes employed on the Continent, is the taking advantage of stray currents in the ground from d.c. traction systems.

Protection of steel in soil is agreed to be achieved if the metal/soil potential is rendered more negative than -0.85 V or -0.95 V in anaerobic soils containing sulphate-reducing bacteria. For lead in soils -0.55 V relative to the copper/copper sulphate half-cell described in the pamphlet has proved successful. A negative limit of -2.5 V has been provisionally adopted by the Joint Committee wherever coatings of structures could be damaged by excessive hydrogen evolution. The negative peak can be reduced by moving the anode further from a coated structure.

Electricity Supply Conference

AT Brighton last Monday there was the usual annual conference of representatives of the electricity supply industry held at the time of the British Electrical Power Convention. Sir Henry Self presided and after congratulating members of the industry who had appeared in the Queen's Birthday Honours, including Lord Citrine and Mr. J. S. Pickles, introduced the three speakers.

The first was Sir Christopher Hinton, chairman of the Central Electricity Generating Board, who gave a lucid explanation of the reorganisation of the generating side of the industry and the reasons for it. He was followed by Mr. Norman Elliott, chairman of the South Eastern Electricity Board, whose general subject was the relationships between the Boards and their customers. Then Alderman W. J. Bennett, chairman of the Eastern Electricity Consultative Council, dealt with the work of the Consultative Councils as the links between the Electricity Boards and the public. Sir Henry Self concluded the programme with a brief but comprehensive survey of the past year's progress and future prospects.

Alderman W. J. Bennett, Sir Christopher Hinton, Sir Henry Self and Mr. Norman Elliott

The speakers from the body of the hall included Mr. Thomas Johnston, chairman of the North of Scotland Hydro-Electric Board, and Mr. J. S. Pickles, chairman of the South of Scotland Electricity Board.

Lord Citrine

Dr. Willis Jackson

Mr. J. S. Pickles

Mr. F. I. Ray

Mr. D. Bellamy

Mr. P. A. T. Bevan

BIRTHDAY HONOURS

MANY ELECTRICAL MEN IN THE LIST

THE Birthday Honours List published last week contains more electrical names than for some time past. From the List we have selected the following who are associated with the electrical and allied industries.

Lord Citrine, P.C., K.B.E., LL.D., Companion I.E.E., a part-time member of the Central Electricity Generating Board and formerly chairman of the Central Electricity Authority, becomes a G.B.E. (Knight Grand Cross of the Order of the British Empire).

Two well-known men are included in the list of new knights. They are **Dr. Willis Jackson,** F.R.S., director of research and education, Metropolitan-Vickers Electrical Co., Ltd., and **Mr. J. S. Pickles,** B.Sc., M.I.E.E., chairman of the South of Scotland Electricity Board.

Mr. J. L. Girling, lately Comptroller-General, Patent Office and Industrial Property Department, Board of Trade, and **Mr. F. I. Ray,** C.B.E., B.Sc.(Eng.), M.I.E.E., Director of Inland Telecommunications, General Post Office, become Companions of the Order of the Bath (C.B.), **Rear-Admiral K. H. T. Peard,** C.B.E., M.I.E.E., Director, Naval Electrical Department, is created a Knight Commander of the Military Division of the Order of the British Empire (K.B.E.), and **Mr. R. J. Ayres,** C.B., C.B.E., deputy secretary, Ministry of Power, becomes a Knight Commander (Civil Division) of the Order (K.B.E.).

Mr. P. F. D. Tennant, O.B.E., overseas director, Federation of British Industries, and **Mr. H. O. Ellis,** O.B.E., Director, Posts and Telegraphs, Federation of Nigeria, are appointed Companions of the Order of St. Michael and St. George (C.M.G.).

C.B.E.

New Commanders of the Order of the British Empire are **Mr. D. Bellamy,** O.B.E., D.L., F.A.C.C.A., F.C.W.A., F.S.S., Companion I.E.E., chairman of the Yorkshire Electricity Board; **Mr. P. A. T. Bevan,** B.Sc., M.I.E.E., chief engineer, Independent Television Authority; **Mr. T. W. F. Brown,** director, Parsons and Marine Engineering Turbine Research and Development Association; **Mr. E. K. Cole,** chairman and managing director of E. K. Cole, Ltd.; **Mr. T. Coughtrie,** chairman of the Belmos Co., Ltd.; **Mr. J. Cowan,** M.I.E.E., principal electrical inspector, Mines Directorate, Ministry of Power; **Mr. L. A. Sayce,** superintendent, Light Division, National Physical Laboratory, Department of Scientific and Industrial Research; **Mr. J. C. Thompson,** B.Sc.(Eng.), A.M.I.E.E., Deputy Director of Electrical Engineering, Admiralty; **Mr. G. H. Wilson,** chairman and managing director of Laurence, Scott & Electromotors, Ltd.; and **Mr. J. L. King,** O.B.E., M.I.E.E., resident engineer in London, Electricity Corporation of Nigeria.

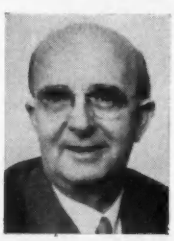
O.B.E.

The list of new Officers of the Order of the British Empire include **Mr. W. T. Ash,** secretary, Radio and Electronic Component Manufacturers' Federation; **Mr. R. W. Reynolds-Davies,** secretary, Institute of Fuel; **Mr. W. E. Hudson,** chief regional engineer, Home Counties Region, G.P.O.; **Mr. R. W. Mann,** M.I.E.E., chairman and managing director, Victor Products (Wallsend), Ltd.; **Mr. S. S. Scott,** M.A.(Oxon), chief personnel officer, Central Electricity Generating Board; **Mr. L. M. Simpson,** chief engineer and manager, Telegraph Division, Automatic Telephone & Electric Co., Ltd.; **Mr. H. A. Tunstall,** B.Sc., Ph.D., assistant research manager, W. T. Henley's Telegraph Works Co., Ltd.; **Mr. D. S. Watson,** senior principal scientific officer, Admiralty Signal and Radar Establishment; and **Mr. A. W. Woodbridge,** M.Sc.(Eng.), M.I.E.E., signal engineer, Western Region, British Railways.

M.B.E.

Among the new Members of the Order of the British Empire are **Mr. E. C. Avery,** who retired early this year from the position of power station superintendent of Littlebrook (Kent) "A," "B" and "C" power stations, South Eastern Division, C.E.G.B.; **Mr. W. J. Barrow,** foreman, Electrical Branch, H.M. Dockyard, Portsmouth; **Mr. W. S. Baxter,** executive engineer, Post Office Telephones, Inverness; **Mr. J. Darragh,** head of the Electrical Stores Department, Harland & Wolff, Ltd., Belfast; **Mr. W. G. DeBoo,** chief mechanical engineer, Cathodeon Electronic, Ltd.; **Mr. E. C. Ferris,** estate and works engineer, General Electric Co., Ltd., Birmingham; **Mr. R. Gray,** chief designer, Chloride Batteries,

Mr. E. K. Cole


Mr. T. Coughtrie

Mr. J. C. Thompson

Mr. G. H. Wilson

Mr. S. S. Scott

Mr. H. A. Tunstall

Ltd., Manchester; **Mr. H. V. Griffiths,** engineer-in-charge, Tatsfield Receiving Station, B.B.C.; **Mr. R. Lewis,** superintendent, Machine Shop, Westool, Ltd.; **Mr. T. C. Loveday,** area engineer, East Telephone Area, G.P.O.; **Miss Mary McGregor Sommervill,** private secretary to the manager, Ayrshire Area, South of Scotland Electricity Board; **Mr. P. L. Anthony,** chief superintendent, Department of Telecommunications, Singapore; and **Mr. C. J. Psintros,** A.M.I.E.E., assistant electrical and mechanical engineer, Cyprus.

B.E.M.

Recipients of the British Empire Medal include the following:—**Mr. D. G. Balfour,** foreman electrician, North Eastern Electricity Board (Newcastle-upon-Tyne); **Mr. E. J. Caudwell,** exhauster and electric generating plant attendant, Bow Common Gas Works, North Thames Gas Board; **Mr. N. Burney,** foreman, F. Perkins, Ltd.; **Mr. J. B. Evans,** chargehand fitter, Ironbridge power station, C.E.G.B.; **Mr. E. F. Foreman,** foreman, Research Laboratories, General Electric Co., Ltd., Chipperfield; **Mr. A. G. Gardner,** chief colliery electrical engineer, Kingshill No. 1 Colliery, Scottish Division, National Coal Board; **Mr. A. E. Kerr,** fitter (electrical), Eastern Electricity Board (London, N.9); **Mr. E. T. Lewer,** chargehand electrical fitter, Royal Aircraft Establishment, Ministry of Supply; **Mr. J. Loughlin,** foreman electrician, Yorkshire Electricity Board (Hessle); **Mr. J. McCannah,** chargehand mechanical fitter, Ferranti, Ltd. (Manchester); **Mr. J. H. Oates,** Pulsometer Engineering Co. (Reading); **Mr. J. N. Pain,** assistant station radio officer, Government Communications Headquarters, Foreign Office (Taunton); **Mr. A. Parkin,** section leader (draughtsman), Worthington-Simpson, Ltd. (Newark); **Mr. H. C. Phillips,** inspector (engineering), Telephone Manager's Office, Canterbury (Chatham); **Mr. C. Prendergast,** lately shift foreman stoker, Bow power station (Dagenham) of the Central Electricity Generating Board; **Mr. R. A. Salway,** foreman, Grade I, Bristol Sub-Area, South Western Electricity Board (Bristol); **Mr. E. Ward,** conveyor attendant, Skelton Grange power station, C.E.G.B. (Leeds); **Mr. A. Watt,** Civil Defence officer, Bruce Peebles & Co., Ltd.; **Mr. G. P. Williams,** Standard Telephones & Cables, Ltd.; **Mr. Amar Singh,** electrical inspector, East African Railways and Harbours Administration; and **Mr. Ting Ho,** assistant electrical inspector, Hong Kong.

Parliamentary Report

End of Coal Rationing

When Lord Mills, Minister of Power, announced in the House of Lords that the rationing and price control of coal were to be ended from mid-July, he gave an assurance that he would keep a careful watch on retail prices.

Later, when the Ministry were asked about the effect the changed policy might have on the N.C.B.'s coal price structure generally, it was stated that eventually the pattern of demand might bring some changes, but no scheme for a new price structure had been submitted to the Minister under the terms of the "gentleman's agreement" by which the Government were consulted before prices were changed.

South Lancashire Trolley-buses

Mr. Arthur Palmer in the Commons last week tabled a motion which will have the effect of blocking the progress of the South Lancashire Transport Bill. Time will have to be found to debate his motion "that this House declines at the present time, for reasons of national economic policy, to agree to the second reading of a Bill which seeks amongst other things to authorise the discontinuance of an efficient service of electrical trolley-buses dependent only on home-produced fuel, and to empower the provision in its place of a system of diesel buses using imported fuel oil."

Financing Research

Mr. Prentice asked the Parliamentary Secretary to the Ministry of Works what steps he proposed to take to increase the scale of Government aid to scientific research for civil purposes, in view of the fact that the first annual report of the new Council for Scientific and Industrial Research expressed concern that their resources were too small.

Mr. Harmar Nicholls said the Government had been providing funds for scientific research in recent years on a steadily increasing scale. They were now awaiting the proposals of the Council for Scientific and Industrial Research for the quinquennium ending 31st March, 1964, and these would receive very careful consideration.

University Technical Facilities

Mr. Chetwynd asked the Chancellor of the Exchequer how many universities would have to curtail their projected developments in building and proposed increases in scientific and technical teaching staff in the academic year 1958-59 owing to the inadequacy of the present quinquennial grant.

Mr. Heathcoat Amory said university buildings were financed by capital grants, which were quite separate from the quinquennial settlement of recurrent grant. As regards scientific and technical teaching staff, some universities might not be able to achieve in 1958-59 as much as they would have hoped but there must be a limit to the resources that could be made available.

North Wales Nuclear Station

Mr. Dance asked for a statement about the outcome of the inquiry into the proposal to site a nuclear power station in the Snowdon National Park.

Sir Ian Horobin said that the Central Electricity Generating Board had now presented the memorandum to which he referred on 19th May, and the other interests represented at the public inquiry had been asked to submit their comments by the end of June.

Opportunities in the Middle East

ON his return last week from a tour of the Middle East, Mr. J. Vaughan-Morgan, Minister of State, Board of Trade, and chairman of the Advisory Council on Middle East Trade, said that he was not dissatisfied with Britain's share of the trade of these countries but he thought we could do better. They were difficult but expanding markets, with a steadily rising standard of living. Although world trade had stagnated, the imports of the Middle East countries had continued to increase. Referring to the efforts of particular industries, he said that electrical equipment, and especially accessories, had done well. The selection of suitable agents was of even greater importance now that the oil companies were buying as much as possible through local merchants. He suggested that principals who visited Australia and New Zealand should break their journeys in the Middle East.

Mr. W. H. McFadzean, chairman and managing director, British Insulated Callender's Cables, Ltd., and vice-chairman and industrial leader of the Advisory Council on Middle East Trade, who accompanied Mr. Vaughan-Morgan for part of the tour, said last week that after-sales service was one of the weaknesses of British exporters. It was increasingly necessary to work with Middle East nationals as agents and, for technical goods, they would have to be trained.

INDUSTRIAL NEWS

Japanese to Order Reactor

On 13th June the Japanese Government announced its decision to purchase in Great Britain a nuclear reactor of about 140 MW rating. It is reported that tenders have been invited from the G.E.C.–Simon-Carves Group, the English Electric-Babcock & Wilcox Group and the A.E.I.-John Thompson Nuclear Energy Co. The total cost, including the erection of the plant by the Japanese themselves, will be in the neighbourhood of £30 million. A special correspondent of *The Times* says that it is possible that the Japanese will place a similar contract in the United States.

An agreement between the British and Japanese Governments for co-operation in the peaceful uses of atomic energy was signed at the Foreign Office in London on 16th June. Mr. Selwyn Lloyd, the Foreign Secretary, signed for Britain, and Mr. Katsumi Ohno, Japanese Ambassador in London, for his country. The agreement enables Japan to purchase from the United Kingdom power and research reactors, together with the nuclear fuel necessary for their operation. It also covers the exchange of unclassified technical information, the possibility of assistance being provided from the United Kingdom in the construction in Japan of plants for manufacturing fuel elements and processing used fuel, and the provision of training facilities in the United Kingdom.

Transformer for Willington "B"

A recent order placed with the Metropolitan-Vickers Electrical Co., Ltd., is for a 225 MVA three-phase generator transformer for the Willington "B" power station of the Central Electricity Generating Board. It will step up the generator voltage from 16·5 kV to 295 kV at no-load for the supergrid.

Although a number of supergrid transformers have been made for 100 MW generators, the new transformer will be one of the first to be made in this country for 200 MW generators. It will be manufactured in the new transformer factory at Wythenshawe, will be oil immersed, and will have forced oil circulation and oil-to-water heat exchangers to provide the cooling. Metropolitan-Vickers resistor transition on-load tap-changing equipment will be provided for a range of 20 per cent in 18 steps with remote electrical control.

Gresham Transformers Export Promotion

Gresham Transformers, Ltd., the Gresham Lion Group, Ltd., and their subsidiary companies, which include Gresham Electronic Transformers, Lion Electronic Developments, Ltd., Gresham Developments, Ltd., and Hughes (Taplow), Ltd., are intensifying their export sales efforts, and to assist in this direction, an explanatory booklet describing the Gresham Group and its products has been produced in English, French, German and Spanish. The booklet gives a well-illustrated survey of the principal groups of transformer application, covering power distribution, heat treatment processes, welding, electrostatic precipitation, radiography, automation and process control, telecommunications, radar, radio, and electronic and electrical equipment generally.

Contract Price Formulæ

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 13th June is deemed to be 186s 6d.

The "costs of materials" figures are: For electrical machinery and equipment the Board of Trade index figure published on 13th June is 176·5 (1949=100) and 113·8 (1954=100); both figures are provisional. For turbo-generating and allied plant: Materials used in mechanical engineering industries 184·5 (1949=100) and 122·8 (1954=100), blast furnaces and iron and steel melting and rolling (40 and 41) 190·8 (1949=100) and 130·0 (1954=100); figures are provisional. The price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 13th June) is 43½d per lb.

Bloemfontein South Resignalling

The new signalling installation at Bloemfontein South, South African Railways and Harbours, was brought into use on 18th May. The contract involved the complete re-signalling of Bloemfontein South State and its approaches. The scheme covered the provision of some twenty-four colour light signals, fifteen searchlight signals, nineteen multiple lamp route indicators, nine stencil route indicators, fifty-one position light shunt signals, sixty-three electro-pneumatic point mechanisms and seventy a.c. track circuits. All functions are controlled from a style "L" all-electric locking frame which is fitted with 147 levers and housed in a newly erected signal box. The contract was carried out by the Westinghouse Brake & Signal Co., Ltd., whose managing agents in South Africa are Bellamy & Lambie (Pty.), Ltd.

Telephone switchboard at the Royal Victoria Hospital, Belfast

Engineering Wages Claim

A claim for a "substantial" increase in wages is to be made on 24th June on behalf of members of the constituents of the Confederation of Shipbuilding and Engineering Unions. The Confederation has already put forward a demand for a shorter working week.

Hospital Telephone Switchboard

A special telephone switchboard, the first of its kind in the United Kingdom, has just been brought into service in the patient inquiry telephone department at the Royal Victoria Hospital, Belfast. This switchboard was manufactured and installed by the private telephone division of Siemens Edison Swan, Ltd.

The manual switchboard has three operators' positions at which all lines, both G.P.O. and internal, are terminated. It is of the cordless type, lever keys being used to establish connections. Lamp signalling is used in all lines and a common audible alarm is provided for slack periods.

All apparatus, including that used for the operators' telephone circuits, is housed in a separate cabinet remote from the switchboard, and to avoid the use of large multi-core cables between the switchboard and cabinet, relays operated by single keys, one set per position, are provided. A single lamp per circuit is used and, in the case of the extension lines to the

internal telephone system, act as calling lamps by flashing, or glow continuously to indicate that the line is engaged.

Reconditioned Cathode Ray Tubes

The Commissioners of Customs and Excise have issued a memorandum regarding the incidence of purchase tax on reconditioned cathode ray tubes of the kind used in domestic television receivers. This states that under the law purchase tax becomes due on all goods of a class chargeable with tax when they are sold or appropriated by a registered or registrable person under taxable conditions. The fact that the goods may be reconditioned goods does not affect the position. As a concession, however, the Commissioners do not require tax to be paid on second-hand goods even if they are sold or appropriated under taxable conditions provided that the goods have been subjected to no more than minor repairs and are kept segregated from new goods both physically and in the trader's accounts.

Pumps for Hinkley Point

G. & J. Weir, Ltd., have received an order from the English Electric Co., Ltd., for ten "Electrofeeders" for Hinkley Point nuclear power station. The order includes eight main feed pumps each discharging 1,150,000 lb/hr at 882 lb/sq in and two emergency pumps each with an output of 120,000 lb/hr at 882 lb/sq in. G. & J. Weir are now supplying the feed pumps for three of the four new nuclear power generating stations under construction in this country.

Brewery Modernisation

Some years before the war John Smith's Brewery at Tadcaster, Yorks., commenced a comprehensive modernisation, re-equipping and enlarging project. This work was interrupted by the war, but started again in 1945, and the scheme is now nearing completion. In the engine room are the refrigerating and air plants which provide the chilling requirements for the brewing side; this plant consists of four Hall ammonia compressors each powered by a 125 h.p. auto-synchronous Crompton Parkinson motor. Another such motor has been installed and will be used to drive an additional compressor to meet further expansion in the future. The lighting scheme in the brewery consists of 270 Crompton Parkinson fluorescent lighting fittings and associated trunking, giving an overall illumination value of 11 lumens per sq ft, except in the engine room where the planned illumination value is approximately 20 lumens per sq ft. All the fittings were supplied with vitreous enamel reflectors in order to simplify cleaning arrangements.

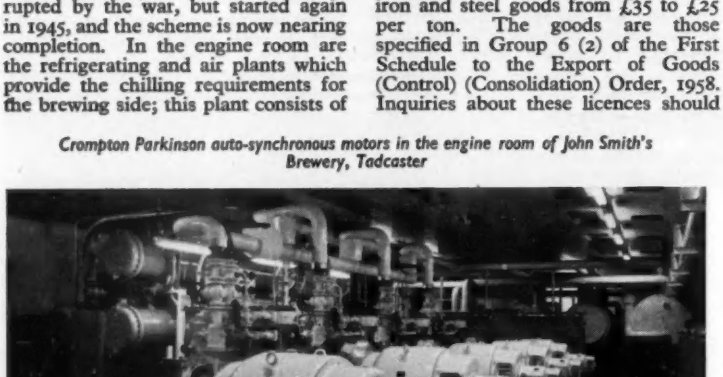
James Hodgkinson Acquisition

James Hodgkinson (Salford), Ltd., has purchased the ordinary share capital of J. & J. Neil (Temple), Ltd., combustion engineers, Glasgow. The board of this company has been reconstituted by the resignation of Messrs. Neil, Welsh and Jarvie and now comprises Messrs. J. D. Cooper (a former director) who is chairman, N. C. Crighton, E. L. Hollinshead and W. Murray, the last-named having been appointed managing director. Continuity of the business of J. & J. Neil (Temple), Ltd., is thus assured.

Open General Licences

The export of certain aluminium, copper and iron and steel goods is controlled to ensure that scrap metal is retained in the United Kingdom. In this connection the Board of Trade announces that the present open general licences are being revoked and replaced by new open general licences which lower the value limits as follows:—Aluminium goods from £240 to £220 per ton; copper goods from £350 to £300 per ton and the value of any alloy mainly of copper in any goods from £240 to £200 per ton; and iron and steel goods from £35 to £25 per ton. The goods are those specified in Group 6 (2) of the First Schedule to the Export of Goods (Control) (Consolidation) Order, 1958. Inquiries about these licences should be made to the Export Licensing Branch, Gavrelle House, Bunhill Row, London, E.C.1 (telephone: Monarch 4071). Copies of the open general licences (price 3d each) can be obtained from H.M. Stationery Office.

Crompton Parkinson auto-synchronous motors in the engine room of John Smith's Brewery, Tadcaster



Government Copper Stockpile

As a result of difficulties arising from the stoppage at the London docks, the Board of Trade is prepared to sell about 2,000 tons of copper from the United Kingdom stockpile to users of this material who can supply evidence that their production would otherwise suffer. Such users should get in touch with the Board of Trade (G.7 Division), Lacon House, Theobalds Road, London, W.C.1 (telephone: Chancery 4411, Ext. 293).

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £202 0s 0d
Fire Refined 99·70%	ton £201 0s 0d
Fire Refined 99·50%	ton £200 0s 0d
COPPER Tubes ..	lb 1s 11½d
Sheet	ton £226 5s 0d
H.C. wire and strip ..	ton £215 5s 0d
LEAD, English ..	ton £72 15s 0d
Foreign	ton £71 0s 0d
MERCURY	flask £76 0s 0d
TIN, block (English) ..	ton £730 5s 0d
ZINC, G.O.B. Foreign	ton £64 0s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 6¾d
Sheet	ton —
Wire	lb 2s 4¾d
PHOSPHOR BRONZE Wire	lb 3s 8¼d
PLATINUM	oz £25 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 22¾d—22¾d

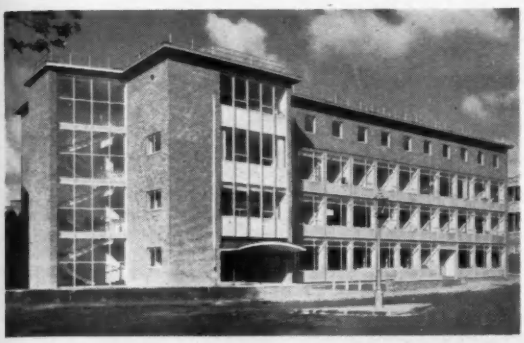
Fruit Picker Awarded Damages

At Devon Assizes Mr. William Pye, a farm hand, was awarded £2,704 damages for injuries received when the metal ladder he was using while picking apples touched an 11 kV overhead line. The damages were apportioned two-thirds against the South Western Electricity Board and one-third against the orchard owner. The accident occurred in 1955.

D.S.I.R. "Open Days"

Two "open days" were held on 4th and 5th June at the Mechanical Engineering Research Laboratory of the Department of Scientific and Industrial Research at both East Kilbride and Thorntonhall. About 2,300 visitors attended and saw some of the projects being carried out.

Researches in progress included tests on models to establish cavitation characteristics, the study of the resistance of suitable materials to cavitation erosion and investigation of the physical phenomena of cavitation. Investigations were also being carried out into the condensing of steam as



New office block of Evershed & Vignoles, Ltd., at Chiswick, which was opened last week by Sir Christopher Hinton. Right: Sir Christopher and Lady Hinton with Mr. D. D. Walker, managing director

discrete drops on a cooled metal surface. The heat transfer rate is much greater with drop condensation than with film condensation. Steam can be made to condense in the form of drops by coating the metal surface with a layer of a water-repellent chemical.

Football Ground Floodlighting

Blackburn Rovers Football Club has awarded a contract valued at £21,000 to the General Electric Co., Ltd., for the floodlighting of its ground at Ewood Park. The installation will comprise four 120ft high towers each carrying 48 floodlights. The G.E.C. is supplying similar floodlighting equipment for Blackpool Football Club. The installation will be completed in August ready for use early next season.

Switchgear for Kuwait

The Government of Kuwait Electricity Department has recently placed a large order for switchgear for use on its distribution system with J. G. Statter & Co., Ltd. (a member of the Lancashire Dynamo group of companies). The value of the order amounts to nearly £175,000 and comprises a total of thirty-six switchboards. The switchgear is for use on an 11 kV, 50 c/s, three-phase system and all circuit-breakers being supplied have an ASTA tested and proved rupturing capacity of 350 MVA at this voltage, and are of 400 A and 1,200 A rating. All the switchgear is of the metalclad oil and compound filled type. A total of 186 single busbar circuit-breaker units and eighteen duplicate busbar units are being supplied.

Evershed & Vignoles' Extension

The new office block of Evershed & Vignoles, Ltd., at Chiswick was formally opened by Sir Christopher Hinton, chairman, Central Electricity Generating Board, on Wednesday, 9th June. It is a four-storey building, of attractive design, and an effect of spaciousness is created by the use of well-planned lighting throughout. This is particularly noticeable in the board room and in the large drawing offices where fluorescent lighting is used to the fullest effect.

Wall murals, the work of Mr. Gerald H. Holtom, which portray the company's activities are a particular feature of the building. Against a background of Sydney Evershed's original drawings is a sketch of the first insulation testing set and above this is shown the first "Megger" insulation tester. A central vertical feature depicts the thin ellipsoid magnet used by Evershed during his researches into magnetism while the upper part is a glimpse into the future, showing a control desk, under a large sphere, representing the company's part in the nuclear age.

The new block will serve as an extension to the present works, originally transferred to Chiswick in 1903, where they now occupy a floor area of approximately 200,000 sq ft, the number of employees being over 1,700. The design of the building was by S. T. Walker & Partners of Birmingham and it was built under their direction by Stanley Peach & Partners, London.

Westool Sales Conference

A sales conference of distributors for "Westair" air conditioning equipment of Westool, Ltd., was held at the Great Eastern Hotel, London, on 29th May. Col. C. E. Mackellar, a director of Westool, Ltd., said that they felt that there was a big future for room air conditioners and dehumidifiers in this country.

Polythene Ducting

A novel and inexpensive method of installing underground telephone cable was used recently at the London Zoo. The electrical contractors, the Telephone & Electrical Maintenance Co., used 1½in bore polythene tubing produced by the Plastics Division of the Telegraph Construction & Maintenance Co., Ltd., as the cable duct. No difficulties were encountered in bending or setting the tubing despite the tortuous route which extended for a distance of 300 yd. A Telcon 10 pair/10 lb conductor, polythene insulated and sheathed (subscriber type) telephone cable was used and drawn into the tubing and terminated in the appropriate place at both ends.

The tubing ensures complete protection of the cable against exposure to soil acids and other corrosive conditions. Further, the use of plastic insulated cable has an advantage over the conventional paper insulated type, which needs a lead covering for its protection, in that the saving in installation and maintenance costs is substantial.

Gauge and Tool Makers' Export Catalogue

The Gauge and Tool Makers' Association has published the fourth edition of its export catalogue. This is in English, French and Spanish, and in addition to containing illustrated particulars of the products of its member companies, briefly outlines the aims, objects and export activities of the Association. The catalogue is being circulated to actual and potential buyers of British tools and gauges in all the principal world markets, and copies are available to all overseas buyers, British firms and agencies, etc., free of charge (postage 8d) on application to the Association at Standbrook House, Old Bond Street, London, W.1.

Works Visit

Six personnel executives from Nigeria, Iraq and British Guiana visited the Woolwich works of W. T. Henley's Telegraph Works Co., Ltd., recently. They were welcomed at the works by Mr. J. C. Duggan (assistant works manager) and conducted round the factory by Mr. J. T. Alderton (safety officer) and Mr. R. D. McAvoy (personnel officer), who showed them the various precautions taken in health and safety matters. The visit was arranged by the Industrial Welfare Society.

Benjamin Electric Sales Conference

A general sales conference of the Benjamin Electric, Ltd., was held during the last week in May at the Hendon Hall Hotel, Hendon, Middx., those attending including the directors, senior executives and the sales force

covering England, Scotland, Wales, Northern Ireland and Eire. Mr. A. E. Iliffe, director of sales, welcomed Mr. H. G. Campbell, joint managing director, who reviewed the last fifty years of the company. Each day during the conference various papers were presented on subjects such as "User Contact in the Industrial Market," "Market Analysis," "Illuminating Engineering Service" and "Publicity and Sales Promotion," and in the evenings study groups were formed. During the conference Mr. Campbell presented to Mr. R. H. Hill, of the company's southern area, a gold wristwatch as the award of merit for sales engineers for 1958. The conference concluded with a visit to the company's Tottenham factories and the laboratory, engineering and research blocks.

Digital Computers

The largest electronic digital computer yet made in Western Europe will shortly be in use for the first time. This computer, called "Perseus," will cost £300,000 and is being made by Ferranti, Ltd., at Bracknell, Berks.

The first two models are to be exported, one to Sweden this autumn for the Trygg and Flygia Insurance Companies of Stockholm, and the other next year to the South African Mutual Life Assurance Society in Cape Town.

The first application of "Perseus" by these insurance companies will be for keeping thousands of policy records. This computer will also do any of the routine work in a large office: control stock, forecast sales, prepare invoices, and work out pay.

The unusual feature of this computer is that it works directly with letters and numbers, no matter what the language or currency. It is built entirely of standard plug-in units, and the complete system includes punched card readers, magnetic tape and high-speed printing equipment.

A second issue of the list of existing "Pegasus" computer programmes has been issued by Ferranti, Ltd., Computer Department, West Gorton, Manchester, 12. The document is intended to provide a scheme for the interchange of information on "Pegasus" programmes between all users of the computer.

Uses of Small Coal

One of the problems which currently face the National Coal Board is the disposal of the large quantity of small coal which it is accumulating. It is likely that the electricity supply industry's demand will continue to rise and the gas industry is conducting research into the total gasification. But with regard to the latter work the Select Committee on Nationalised Industries (Reports and Accounts) says that no large-scale results can be expected for four years yet. In its latest report (187-I, H.M. Stationery Office, price 9s 6d) the Committee also refers to progress made in the briqueting of small coal but it is "not entirely convinced that the [National Coal] Board have put sufficient drive into developing the results of their scientific researches."

Paper Board Mill

An illustration on page 1035 of our issue of 30th May shows the main motor generator set and switchboard for all wet end and dryer section drive units of the new mills of Colthrop Board & Paper Mills, Ltd., at Thatcham, Berks. This large drive motor switchboard was made by the Watford Electric & Manufacturing Co., Ltd., for Harland Drives, Ltd.

New B.I.C.C. Dundee Offices

To mark the official opening of the new Dundee sales branch office of British Insulated Callender's Cables, Ltd., at 2, South Ward Road, Dundee (telephone: 5926/7), a special exhibition of some of the company's products was held on 11th June. The items shown included wiring systems, mineral insulated cables and accessories, rising main boxes and capacitors for power factor correction. There was also a demonstration of terminating m.i. cables. Among the guests were Mr. R. B. Anderson, area manager, North of Scotland Hydro-Electric Board, Dundee, and Mr. G. B. Vinnycombe, chief engineer, Jute Industries, Ltd. The premises are three times as large as the old ones in North Lindsay Street, and are arranged on one level for ease of handling stocks. The specially designed storage arrangements enable a greater quantity of stock of insulated cables, winding wires, accessories and jointing compounds to be held. Mr. R. A. Arnold is the manager of the branch.

Ferranti "Perseus" computing system

Trade Announcements

The move from Pritchett Street, Birmingham, to the new works at Redbrook Lane, Brereton, Rugeley, has now been completed by the **Electric Depot, Ltd.**, and the new factory and offices are now in full operation.

Honeywell-Brown, Ltd., has changed its name to **Honeywell Controls, Ltd.** All head office departments and the London branch office have moved to Ruislip Road East, Greenford, Middlesex (telephone: Waxlow 2333).

The Birmingham branch of the **English Electric Co., Ltd.**, has been moved from 75, New Street, to larger premises at Pitmaston, Moseley, Birmingham, 13 (telephone: South 4021/5). The domestic appliance sales section is also at the new premises, but the appliance service depot remains at 175, Tennant Street, Birmingham, 15 (telephone: Midland 2803).

The new factory of **Truvox, Ltd.**, is now almost completed, and the company has commenced transferring its stores. The removal of all departments will be completed by 7th July. The new address is Truvox, Ltd., Neasden Lane, London, N.W.10 (telephone: Gladstone 6455). The Service Department can still be contacted by telephone at its old number, Harrow 4455.

The sales division of **Nettle Accessories, Ltd.**, is now at Warren Street, Stockport, Ches. (telephone: Stockport 7155).

Mr. N. Gladstone has joined the sales staff of **Belling & Co., Ltd.**, as representative for the Yorkshire area.

The **Du Pont Co. (United Kingdom), Ltd.**, is to construct an elastomers research laboratory at Hemel Hempstead, Herts., which will have a floor area of 10,000 sq ft.

Annual Holidays

The works of Bruce Peebles & Co., Ltd., will be closed for the Edinburgh Trades holiday from 4th to 21st July.

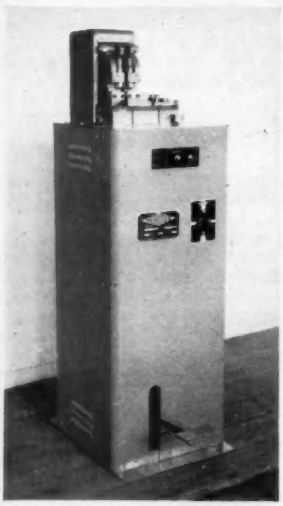
Change of Address

The British Association of Machine Tool Merchants is removing to larger office premises on 24th June at Effingham House, Arundel Street, Strand, London, W.C.2 (telephone: Temple Bar 6101/4).

NEW ELECTRICAL EQUIPMENT

Butt Welder

A pedal-operated butt welding machine, the PB3, rated at 3 kVA, is announced by MERITUS (BARNET), LTD., Wood Street, Barnet, Herts. The complete welding cycle, including clamping the work pieces, is carried



Meritus PB3 butt welder

out by one stroke of the foot pedal. The welding transformer output is controlled by a four-position snap-action tapping switch and the welding current duration by an electrically energised contactor in conjunction with a micro-action limit switch, which can be adjusted to give any desired amount of collapse at the welding faces. A weld/test switch and indicator lamp is fitted to the machine to facilitate the accurate adjustment of the limit switch.

Welding pressure is applied through an adjustable spring in conjunction with the foot pedal movement and the welding cycle is completely automatic after the limit and heat switches have been set. After-weld annealing can be carried out on the PB3, this feature being particularly valuable when high carbon steels are being welded. Maximum intermittent capacity is $\frac{1}{16}$in diameter steel rod.

Switch-Tripping Equipment

A range of switch-tripping equipments based on a standard size folded steel cabinet has been developed by CHLORIDE BATTERIES, LTD., Clifton Junction, Manchester. The cabinet is more compact than previous designs, but is capable of accommodating batteries of higher capacities than before. Standardisation enables the new equipments to be offered at generally lower prices than before. The cabinet, with either a two-rate charger or trickle charger only, will accommodate six different types of Chloride 15-cell batteries, making a range of 12 equipments. A feature of the cabinet, which measures 48in high

Chloride switch-tripping equipment cabinet

by 12¼in deep by 22in wide, is that the control gear chassis can be quickly withdrawn from the upper portion for maintenance purposes.

Earth Lead Tester

An earth lead tester produced by GRESHAM TRANSFORMERS, LTD., Hanworth, Middlesex, is intended for use on 240 V, 50 c/s single-phase supplies and has been subjected to official tests and field trials.

A rapid test is made for ascertaining the continuity and adequacy of the earth lead of a tool or appliance, the supply lead of which is plugged into one of the standard three-pin sockets on the panel. The resistance of the lead is measured before the main test which consists of passing a current of 100 A through the lead for two seconds. The resistance of the lead is again measured and finally a mains voltage is applied to the tool or appliance to ensure that it is in working order. If the lead is defective to the extent of requiring examination, the resistance after the main test will be higher than before it. If there is an open-circuit the resistance will be infinite. If both resistance tests are identical, the lead is satisfactory.

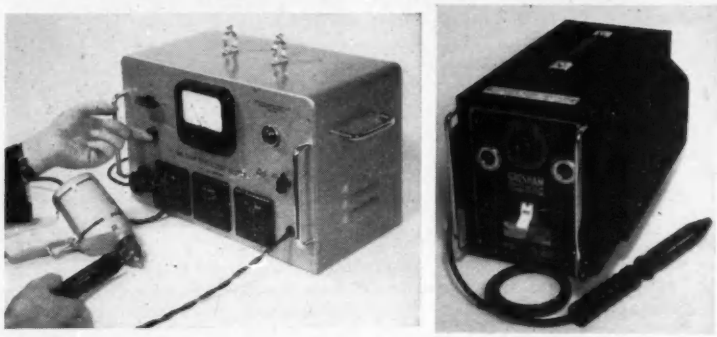
The company has also recently introduced the Mark III portable insulation flash tester which is illustrated below with the earth lead tester. In describing the flash tester in last week's issue we regret that the wrong illustration was reproduced.

Expulsion Fuses

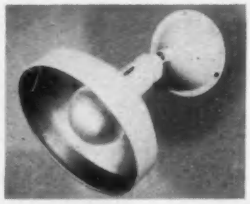
The single-pole 11 kV drop-out expulsion fuse (type DOEF), made by SWITCHGEAR & EQUIPMENT, LTD., Southam Road, Banbury, has now been fully tested at KEMA to 150 MVA in strict accordance with B.S. 2692. It is claimed that this fuse is the first equipment of its type to reach this standard of performance.

Aluminium Surface Finish

A patented form of anodic treatment which produces a very hard surface on aluminium reflectors is now available in Britain. VERITYS, LTD., Plume Works, Aston, Birmingham, 6, have concluded agreements with the West German company which developed the process. Initially Veritys will handle sales of German reflectors and other "Alux" products for incorporation in their own and other manufacturers' equipment. Shortly they expect to make products with this finish in this country. The "Alux" reflectors can be washed or wiped to remove dust, but due to the dielectric quality of the finish, dirt tends to be repelled. Any degree of texture can be applied either to obtain the required amount of light diffusion or for decorative purposes, and the reflectors can be finished in any colour. A series of international standards tests have shown that whilst "Alux" maintained its reflectivity of



Gresham earth lead tester and (right) Mark III portable insulation flash tester



Display lamp fitted with coloured "Alux" reflector available from Veritys

89·7 to 93·5 per cent after exposure to average industrial atmospheres for a year, silvered mirror dropped from 89·9 to 86 per cent, polished unoxidised aluminium from 72 to 47 per cent and chromium from between 64 and 70 per cent to 4 per cent.

The finish is also of interest to the photographic industry and for domestic and infra-red oven heater reflectors. Tests have shown that the material will maintain its efficiency to 200 deg C and further tests up to 300 deg C are being carried out. Where the finish is required for infra-red heaters it is essential to relate the thickness of the finish to the frequency of the ray.

Fire Extinguisher

The development of the "Gwish" aerosol fire extinguisher by DEB CHEMICAL PROPRIETARIES, LTD., Belper, Derbyshire, now makes it possible to install an inexpensive fire fighting appliance beside each work-bench or office desk to deal with minor outbreaks of fire. The extinguisher, which is less than one-third the cost of normal type extinguishers, is in the form of a metal cannister and contains twelve fluid ounces of extinguishing liquid, released as a powerful jet spray by depressing the discharge nozzle. It is claimed that the spray douses flames instantly and carries 6ft with a 3ft diameter coverage. The extinguishing fluid, being a non-conductor of electricity, is safe and effective on all fires, whatever their cause. The extinguishers, price 12s 11d each, are sold in cartons of one dozen, complete with fixing brackets.

NEW STYLE ELECTRIC COOKER

THE Creda "Mercury" cooker makes several interesting departures from normal British cooker design, and it has in fact been developed with an eye on the requirements of the European market. Although the standard version of the cooker incorporates a number of features that are often considered as "extras" it will be sold at the relatively low price of 34 guineas. There is also a de luxe version at 39 guineas.

The hob is a one-piece vitreous enamelled steel pressing to which the three Creda "Quick Discs" are sealed by stainless steel rims. It is therefore impossible for spillage to enter the cooker and a trough round the discs ensures that it does not run on to the floor. The height of the hob has been reduced to 33in, which is considered to be more convenient and comfortable, but where the cooker has to be lined-up with a standard 36in working surface a 3in plinth is supplied free.

The three boiling discs are of one size, 180 mm (just over 7in) in diameter, and each is rated at 3 kW. They are all designed to give fast boiling, and one has an extra boost to reduce the time taken to heat up from cold. The control for each disc is infinitely variable.

The top casting of the discs, of a special rust-resistant iron alloy, is thin and light so that it heats up and responds quickly to changes of control setting. The heating wire is coiled on a fine mandrel and embedded in insulating cement in narrow grooves; since this enables a great length of wire to be used, the wire temperature is reduced and a longer life obtained. To reduce the thermal stresses in the casting the coil is arranged to give a uniform temperature over the casting except at the extreme edge and at the unheated centre. The manufacturing process includes heat treatment cycles which stabilise the casting and prevent subsequent distortion.

Since the loading of the discs is much greater than they could withstand if left on continuously, the energy regulators remain in operation even when the controls are set to the full-on position. When first switched on to this position the contacts of the regulator remain closed for 45 seconds, so that the disc heats up quickly at full power, and they then automatically close and open in a regular cycle to give an average loading consistent with the size of the disc.

With the fastest plate an additional control is used so that the initial heating period is extended to three minutes, by which time the temperature of the disc has nearly reached the normal working maximum. In addition to giving a quicker initial heating from cold, the regulator boost system compensates for variations of supply voltage by varying the length of the "on" period in each cycle. This also enables the whole range from 200 V to 250 V to be covered by two voltage ranges instead of four.

The grill is located in a recess in the roof of the oven and is controlled by a setting of the oven thermostat, which also protects it against overheating if the oven door is shut when the grill is on. The 2,250 W grill element burns itself clean each time it is used. The grill pan slides on the oven runners and is designed to reduce the splashing of fat. When not in use the grill pan is placed in a special stowage in the roof of the warming drawer compartment. The 3,176 cu in oven is the same as on the Creda "Carefree" but is finished in black. It is rated at 2,500 W. The warming drawer, which has a 400 W element, can be removed for cleaning. All the control knobs are placed on the top of the splashplate and are clearly marked.

In addition to the standard features described above, the de luxe model has an oven timer mounted on the left-hand side of the splashplate, which also controls the drawer element; an inner glass oven door; and an oven light. Both models will be available in white or cream and the overall dimensions are 20in wide by 22¾in deep by 41$\frac{13}{16}$in high. The total loading is 11·9 kW. The cookers were shown privately to the staffs of the Electricity Boards at the B.E.P.C. at Brighton this week and will be on sale to the public in September.

Creda "Mercury" cooker

The grill is located in a recess in the oven roof and the grill pan is designed to reduce the splashing of fat

At the Annual General Meeting. Left to right: Messrs. J. Anderson (treasurer), W. Wetton (general secretary), J. E. Ridley (president), S. Winstanley (president elect) and J. P. Morton (past president)

Mining Engineering

A.M.E.M.E. PROCEEDINGS AT BUXTON

WITH a listed membership of about 460 delegates and invited guests the annual convention of the Association of Mining Electrical and Mechanical Engineers was held at Buxton last week, when in the poorest of June weather proceedings commenced on the Tuesday with a council meeting which was followed by an informal reception.

Business proper started on the following morning with the holding of the Association's annual general meeting at which the retiring president, Mr. John E. Ridley, gave over his office to Mr. S. Winstanley, manager (mining) with W. T. Glover & Co., Ltd., the new president for the coming year.

At the end of the meeting Mr. Winstanley delivered his presidential address on "Engineers and Management" in which he examined the qualifications essential to higher administrative positions and indicated that a professional engineer through his training and experience should well satisfy the requirements.

President Mr. S. Winstanley speaking at the Association of Mining Electrical and Mechanical Engineers' conference

The basic essential was a degree or the equivalent qualifications required by appropriate institutions. The second was a talent for leadership and for securing co-operation; the trained engineer, through his apprenticeship and subsequent experience in the handling of men, had come to understand their attitudes and problems. The third requisite was an appreciation of the value of money; the engineer was concerned with the cost aspect affecting the volume of work done in relation to time, the value of materials and the making of economic choice between alternatives; it was therefore easier to train an engineer in commercial practice than a commercial specialist in the techniques of production. The fourth function of management was an ability to make decisions that could be translated into effective action with known results; this ability depended on the selection and welding together of a team of specialists and the delegation of responsibility under executive control—all of which came within the compass of the professional engineer, who could also visualise "the shape of things to come."

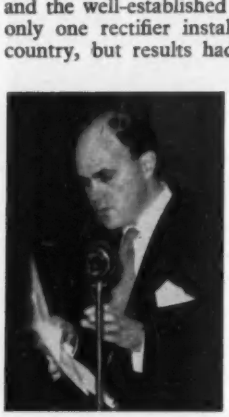
The final requirement, the possession of the "commercial instinct" or the ability financially to equate supply and demand, was created by an engineer's training and the additional knowledge to apply it to the overall concept of management could be readily acquired by trained engineers. The missing features in the engineer's training and experience in relation to commerce appeared to be in techniques of accountancy, cost accounting, budgetary control and market research, but with his mathematical skill and varied experience only a little time would be required to obtain the requisite knowledge. Many of the modern tools of management such as work study and method study were within the province of the engineer. It was therefore more logical that he should be the manager of an industrial undertaking with the assistance of legal, commercial and other specialists than that a lawyer or accountant should be manager with the assistance of technical specialists.

Mine Winders

At the Wednesday afternoon technical session a paper "Taking Stock of Mine Winders" was presented by Mr. O. T. Evans, chief engineer, Electrical General Engineering Department, Metropolitan-Vickers Electrical Co., Ltd. Three reasons for changing earlier practice were given by the author. They were: a clearer understanding of servo-mechanisms as a means of securing greater accuracy of control; recognition of the advantages of the friction drive; the use of more than one rope for suspending the conveyance. The new methods had not yet been in operation sufficiently long to permit the drawing of final conclusions. Automatic operation was technically feasible and justifiable as securing consistency of winding over a long period and a high-accuracy control system was desirable.

The three most suitable driving methods in the majority of cases were: the a.c. motor, which was likely to be restricted to applications such as service shafts at low winding speeds and where continuous operation over long periods was not required; the mercury-arc rectifier/invertor, which could either deliver power to or accept

power from the motor and might supersede other systems; and the well-established Ward-Leonard set. At present only one rectifier installation was in operation in this country, but results had been so promising that many others were now being made of which some would be in service this year. Discussing the relative merits of field or armature reversal for winder control, the author pointed out that while the former took longer it could be made completely static, but the latter required heavy contactors.



Mr. O. T. Evans giving his paper at the Association of Mining Electrical and Mechanical Engineers' conference at Buxton

For the Ward-Leonard system, the closed-loop control would probably be simplified, e.g. rotary amplifiers might be superseded by static magnetic amplifiers or, later, by semi-conductors, and contactors in control circuits might be replaced by static switching devices to reduce maintenance. This system, though more expensive in itself than a rectifier that might be otherwise more suitable, was often cheaper after taking into account the precautions necessary to keep voltage fluctuations within the limit of 1 to 3 per cent imposed by the supply authorities. The kVA input to the rectifier, as to the a.c. motor, rose to its peak at the start of the wind, whereas it took two-thirds of the acceleration period with the Ward-Leonard set to reach peak value and thereafter fell to its full-speed value. The effect of harmonic interference from rectifiers could be limited to an acceptable amount by using the requisite number of phases, normally twelve.

The multi-rope friction winder was probably the most suitable type for the majority of new shafts. Its major advantages were: no limit was imposed on the load that could be wound; far greater efficiency resulted from heavy loading at low speeds; easily handled light ropes could be used; site layout could be planned without the restriction imposed by a drum-winder house; usually lower installation costs; and much greater safety than with a drum winder. Improvements suggested were reduction in inertia of and space occupied by brake mechanism and the interlocking, mechanically and electrically, of all operational sequences on the winder and decking equipment so that every person directly concerned must give his consent before the start of an operation. The use of signal recorders with the time of sending would also be a desirable feature.

In opening the discussion on Mr. Evans's paper, Mr. E. Loynes said the move towards highly accurate automatically controlled or supervisory manually controlled winders had considerably increased both the cost and complexity of the equipment and he suggested consideration as to whether this was really justified.

Mr. Brown stressed five basic governing conditions—simplicity of equipment, reliability of equipment, consistency of operation, capital cost, and running cost. He expressed the opinion that any widespread adoption of automatic winding was unlikely to benefit the user and that it should be applied only after careful consideration of the conditions.

Mr. Metcalf did not think the industry should give up trying for the goal of automatic winding provided it had equipment which did not need a lot of "nursing," and he thought the Ward-Leonard d.c. winder was certainly in that field. He thought the conception of the tape signal recorder was quite wrong because it was not necessary to keep information for ever.

Mr. Timberlake asked if any consideration had been given to the tubular structure of the tower or head gear.

Mr. Hipson said that if we could get safe operation of electrical winding on a closed-loop system for 13 per cent increase in cost that meant 0·6 per cent per year on "tonnage," which was very little.

Mr. Morton asked if any consideration had been given to the small-bulk silicone rectifier which might allow some automatic power compensation without increase in cost?

Mr. Ivor David thought we should not dispose of the rotor arm equalisation too easily.

Mr. Peirce asked what was the lift practice in the skyscrapers of New York and did they use rope equalisers?

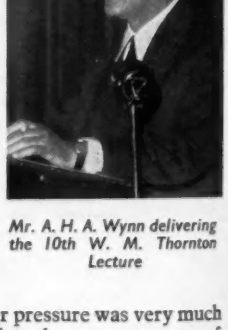
Mr. Roskoe said that multi-rope winders recently installed gave the appearance that rope equalisation was not necessary.

Mr. Worrall said he had found in South Africa that 80,000 combinations were involved in an automatic signalling system and that the system could be defeated on three sets of combinations.

During the day there were visits to various potteries in the Stoke area by the ladies attending the conference. On Wednesday evening there was a civic reception by the Mayor and Mayoress of Buxton, Councillor and Mrs. G. E. Motion, who were supported by the president and Mrs. Winstanley. The whole of Thursday was devoted to a visit by train to the Calder Hall power station of the United Kingdom Atomic Energy Authority where the visitors were given an outline of the operation of the station, a description of which was published in the *Electrical Review* of 19th October, 1956.

Developments in the Use of Coal

At a technical session on the last morning of the conference, Mr. A. H. A. Wynn, M.A., scientific member of the National Coal Board, delivered the 10th W. M. Thornton Lecture on "Developments in the Use of Coal." He said that the United Kingdom was not well provided with natural resources of energy, but had a larger production and consumption of coal per head of population than any other country in the world. Great improvements in the utilisation of coal were also necessary to improve the ability of coal to compete with imported oil.



Mr. A. H. A. Wynn delivering the 10th W. M. Thornton Lecture

Regarding the commercial manufacture of gasoline and diesel fuel from coal in the United Kingdom, he said that estimates based on the best existing knowledge suggested that it was possible, although there were many difficulties to be overcome. A substantial advance in the art of gasification under pressure, essential for successful oil synthesis, would have more important results. The cost of distributing energy in large quantities in the form of gas produced under pressure was very much lower than the cost of distributing the same amount of energy in the form of electricity or coal by rail or road. A high-pressure gas grid could cope with much of the variation in consumer demand within a period of 24 hours by variations in grid pressure.

The contraction of the use of solid fuel by the small

user was likely to proceed very slowly because the demand for different fuels depended upon the standard of living and upon the distribution of the national income. Only those in the higher income groups could afford to use electricity as a main means of providing heat; gas was cheaper; solid fuel was much cheaper still. Research at the N.C.B. Coal Research Establishment has shown that there are important technical possibilities of producing much better solid fuels.

If nuclear energy could release coal from its present use in power stations and make it available for use at two or three times the efficiency in pressure gasification plant, it would make a contribution greater than was apparent in the figures of the present nuclear programme. The use of nuclear heat for the gasification of oil and coal was probably a long way in the future but might well in the end make a large contribution to the country's energy supplies.

Following the lecture a vote of thanks to Mr. Wynn was proposed by Mr. Ridley, the immediate past president, and the Thornton Medal was presented to the author by Mr. Winstanley.

Coal Preparation Plants

On Friday afternoon a paper on "Some Aspects of Electrical and Mechanical Engineering with Regard to Coal Preparation Plant" was presented by Messrs. J. E. Chick, technical director, Washery Division, Simon-Carves, Ltd., and Mr. F. Egerton, chief electrical engineer of the same organisation. They said the use of electrical equipment in modern coal preparation plants had grown over the past 20 to 30 years. The main reasons were the improved techniques and knowledge now available both in the manufacture and application of electrical equipment, and also the increased use of unit drives which demanded more electrical equipment, when compared with the larger motor and line-shafting arrangement.

Before 1939 many preparation plants were provided with the oil-break type of hand-operated starter, some with starters near each motor, and others mounted in groups with a common busbar chamber. Since 1939 there had been a tremendous step forward in the application of air-break contactor starters operated by push-buttons, and they were now used in almost every case for controlling motors operating on systems up to 660 V.

The cheaper method of earth leakage protection was group protection designed to trip with an earth leakage current in excess of 5 A, so that all sub-circuits were adequately protected. The alternative was to provide earth leakage protection on each starter, designed to meet the 5 A or 15 per cent requirement of the Draft Regulations.

The majority of motors used in coal preparation plants were of the squirrel cage type which were not quite so expensive as slip-ring machines with their more complicated control gear and additional maintenance requirements. A wider application of the standard torque squirrel cage motor was made possible by the use of centrifugal and fluid couplings, particularly on large drives requiring smooth take-up and a high torque on starting and where a slip-ring motor would previously have been employed. It was now generally accepted that the motor frames should be of the totally-enclosed, fan-cooled type, although drip-proof machines had been used successfully in some wet coal sections.

The paper also dealt with heating and lighting, communication systems and power factor correction for coal preparation plants.

In the discussion Mr. R. D. Allison noticed it had been suggested that some motors of up to 325 h.p. had been fed from a 550 V supply, but his personal opinion was that other steps should have been taken to feed them at a higher voltage than that, even though the main incoming voltage may have been 1,000 V.

Mr. Wardlaw said manufacturers should submit a scheme of maintenance to the various area mechanical and electrical engineers. Mining engineers were spending a lot of time drawing up schemes, and that time could be more usefully used in other directions.

Mr. R. H. Morgan queried the wisdom of fitting up the typical coal preparation plant described by the authors with two 2,000 kVA transformers; he thought it would have been better to have three 1,000 kVA transformers and use any two out of three.

Mr. R. T. Lythall pointed out that the authors had admitted that the impedance of each transformer had to be increased. With four 750 kVA transformers this would not be necessary.

The conference was concluded by the president's reception and annual banquet on the Friday evening when the toast of "The Association of Mining Electrical and Mechanical Engineers" was proposed by Mr. J. Latham, C.B.E., deputy chairman, N.C.B. Responding, Mr. S. Winstanley assured Mr. Latham that the Association would endeavour to uphold the responsibility placed on its members by the Ministry of Fuel and Power and the National Coal Board in their endeavour to promote the safe and efficient operation of the mining electrical and mechanical equipment.

Mr. J. D. Ridley proposed the toast to "The Borough of Buxton and the Guests," which was responded to by the Mayor of Buxton.

Advocates of Electric Traction

AT the recent annual conference at Blackpool of the Institute of Traffic Administration, the president, Lord Merrivale, in his opening address, made a strong plea for a reversal of the regrettable trend in urban road passenger transport in this country, namely, the decrease in or the abandonment of electric passenger transport, which could not be in the public or the national interest from whatever angle it was viewed. Government policy for the future was to produce a larger quantity of electricity from nuclear energy in order to make the country less dependent upon imported fuel. Therefore, and it was only logical, we should be planning to increase our electric transport in every direction. A vast body of public opinion was against the present policy which must obviously be wrong, especially from the aspect of common sense with this country placed as it is in regard to fuel supplies.

Many factors had worked towards the present state of affairs one of which, Lord Merrivale felt, was that education in transport had in the main become very one-sided. It was not broadly based as it should be, with plenty of opportunity in technical institutes for studying electric traction in all its branches. During the war the Government asked undertakings with electric traction systems to run them to the maximum possible extent. This was done with the result that these systems were practically run to death with virtually nothing being spent on maintenance. But was this a proper excuse for abandoning them after the war as had been done in so many cases?

At the annual conference of Ratepayers' Associations, held recently at Caxton Hall, London, a resolution was passed to the effect that the conference considered trolley-buses preferable to diesel buses and in the national interest pressed the Minister of Transport and Civil Aviation to halt the abolition of trolley-buses in London and elsewhere.

Financial Section

STOCKS and SHARES

IN the prospectus published last week in connection with the big issue of Associated Electrical Industries debenture stock, there was much of general interest about the position of the group and present progress. The debenture issue is being made with the purpose of repaying loans and of contributing towards further capital expenditure of the order of £22 million over the next three years. This will follow upon expenditure of some £36 million completed under that heading in the four past years. At the start of the current year, orders on hand totalled about £180 million, and further orders to a value of over £56 million were booked in the following four months. Turnover also increased in that period of the present year, and an upward trend is expected to be maintained by the coming of new plants into operation. Net trading profits have been showing a small contraction, in comparison with the early months of 1957, but the period is too short for this to lead to any reliable deductions. A.E.I. ordinary shares have been steady recently at around 47s 6d, offering a yield of a little over 5¼ per cent on the 15 per cent dividend.

A.E.I. Debenture

Subscription lists were open last Tuesday for the public issue of £21·5 million (part of a total of £25 million) 6 per cent debenture stock by Associated Electrical Industries at a price of 98½. Allotment letters were expected to be posted in time for dealings to begin to-day (Friday). At the beginning, the stock will be £20 per cent paid-up, with calls of £50 per cent due by 15th July and the final £28½ per cent by 12th September. Meanwhile stock will be transferable free of stamp duty. Redemption dates are between 1978–83, and a sinking fund will be in operation in 1963. According to the prospectus, the principal amount of the debenture is covered more than five times over by total net assets, and the amount of the annual interest nearly eight times by average profits of the last three years. Dividends will be paid at the end of April and October, with an initial payment of broken amount next October.

Metal Industries

In order to have funds readily available to take advantage of opportunities for expansion, Metal Industries have decided to part with their holding of £1¼ million British Oxygen ordinary stock, and are offering the £1 units to their own stockholders at 30s each. Dealings in the British Oxygen shares began at a premium of around 3s 9d, and Metal Industries £1 shares were quoted at 30s ex-rights to the offer. Metal Industries' financial year ended in March. On the last occasion the final dividend, and the preliminary statement of the results, were announced early in July, when a net profit of £800,000 was disclosed and the distribution was brought up to a total of 9 per cent, with the addition of a special bonus of 5 per cent to compensate for the absence of any payment in the previous year. For the latest twelve-

Price Changes in

Company or Board	Nom. Value	Middle price 16th June	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1958 Highest	1958 Lowest
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	75½	+½	3	3	3 19 6	75½	72
Brit. Elec. 1974/77	100	73	+½	3	3	4 2 3	72½	68½
Brit. Elec. 1976/79	100	76½	+½	3½	3½	4 11 6	76½	72
Brit. Elec. 1974/79	100	86½		4¼	4¼	4 18 3	86½	82½
Overseas Electric Supply								
Calcutta Elec.	£1	16/-		6†	6·8†	8 10 6†	16/9	15/-
East African Power	£1	18/6	+6d	7	7½	8 2 3	19/3	17/6
Nigerian Elec.	£1	15/-		10	10	13 6 9	17/-	14/9
Perak Hydro-Elec.	£1	14/6		10	12½	17 4 9	15/6	14/-
Electrical Shares								
Aberdare Holdings	5/-	11/9		17½	17½	7 9 0	11/9	9/9
Aerialite	1/-	7/-		48	51½	7 7 0	7/-	5/1
Allen, W. H.	£1	37/-	+9d	10	11	5 19 0	37/-	32/9
Anglo-Portuguese Tel.	£1	26/9		8	9	6 14 6	27/3	19/9
Aron Elec. Ord.	£1	57/6	+1/9	15	15	5 4 3	57/6	53/-
Assoc. Elec. Ord.	£1	47/6		15	15	6 6 3	51/3	46/6
Automatic Tel. & El.	£1	65/-	+1/3	17	17	5 4 6	66/3	57/-
Babcock & Wilcox	£1	47/9		15	13‡	5 8 9	52/9	41/9
Bakelite	10/-	19/3		15	15	7 15 9	21/-	17/6
Baldwin, H. J.	2/-	3/-		20	20	13 6 9	3/9	2/9
Berry's Electric	5/-	7/-		—	10	7 2 9	7/6	5/9
British Aluminium	£1	43/-	+6d	12	12	5 11 6	47/-	37/-
Brit. Elec. Traction: Def. Ord. "A"	5/-	24/-		22½	25	5 4 3	24/-	19/6
B.I. Callender's	£1	45/6		12½	12½	5 10 0	45/6	38/9
B.I. Callender's 6% Pref.	£1	19/-	−6d	6	6	6 6 3	20/3	19/-
British Tabulating	£1	47/6		9	10	4 4 3	47/6	38/6
British Thermostat	5/-	28/9	+1/3	25	30	5 4 3	28/9	19/9
British Vac. Cleaner	5/-	4/9		10	10	10 10 6	5/3	4/6
Brook Motors	10/-	37/6		25	25	6 13 3	37/6	33/3
Bulgin, A. F.	1/-	5/-		40	45	9 0 0	5/6	4/7
Bulpitts	5/-	7/6		—	12½‡	8 6 9	7/6	7/6
Burco Dean	5/-	9/-		20	22½	8 6 9*	9/6	7/9
Cable & Wireless: Ord.	5/-	10/6		10	10‡*	4 15 3	10/6	8/-
4% Loan	100	94½	+½	4	4	4 4 9	94½	89
Chloride El. Storage "A"	£1	57/6	+9d	17½	17½	6 1 9	62/-	55/6
Clarke Chapman	£1	112/6		27½	27½	4 17 9	7½	5½
Cole, E. K.	5/-	17/6		17½	17½	5 0 0	18/-	15/6
Cossor, A. C.	5/-	4/6		Nil	2½	2 15 6	5/6	4/4
Crabtree	10/-	26/6	+6d	20	20	7 11 0	26/6	24/4
Crompton Parkinson Ord.	5/-	10/6		16	16	5 1 6*	10/6	8/3
De La Rue	10/-	26/3	+9d	30	35	6 13 3*	26/3	20/9
Decca "A"	4/-	24/3		43½	43½	7 4 3	27/6	21/3
Desoutter	5/-	14/6		32½	18½*	6 9 3	14/6	13/6
Dewhurst	2/-	8/-		16½	20	5 0 0	8/-	6/9
Dictograph Tel.	2/-	6/3	+3d	20	20*	6 8 0	6/3	4/7
Dubilier Condenser	1/-	4/-	+3d	30	30	5 0 0*	4/-	3/1
Duport	5/-	7/9		25	25	8 1 3*	9/4	7/9
E.M.I.	10/-	34/6	−6d	15	15	4 7 0	35/-	27/6
Electrical Components	5/-	7/6		25	12½*	8 6 9	8/-	7/-
Elec. Construction	£1	23/9	+1/3d	8½	8½	7 3 3	23/9	21/-
Elliott-Automation	5/-	14/3		—	10‡	3 10 3	14/6	11/6
Enfield Cable Ord.	£1	15/-	−6d	Nil	2½	3 6 9	17/-	10/9
English Electric	£1	52/6	+1/3	14	14	5 6 9	56/3	44/-
English Electric 3½% Pref.	£1	12/-	−3d	3½	3½	6 5 0	12/3	11/9
Ericsson Tel.	5/-	20/3		22†	12*†	2 19 3†	21/-	17/6
Ever Ready	5/-	18/-	+6d	37½	20*	5 11 0	18/-	13/9
Falk Stadelmann	£1	38/9		17½	17½	9 0 9	38/9	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

month the interim dividend was raised from 3 to 4 per cent.

Firm Markets

In the gilt-edged market of the Stock Exchange, Government stocks continued to move upwards, on Bank Rate considerations, while industrial shares remained generally very firm, with good features outstanding here and there. Among the leaders in the electrical engineering section, English Electric improved 1s 3d, to 52s 6d, and C. A. Parsons 2s, to 46s 6d. In the cable group, B.I.C.C. retained their previous gains. W. H. Allen, British Thermostat, Laurence Scott, Head Wrightson and Ever Ready all continued to reflect satisfaction with the dividends and results published earlier. Hoover and J. Lucas were noticeably in favour and there was a further improvement to 4s in Dubilier Condenser: this company's financial year ended in March, and the results will be due next month. Gains of 1s or more were recorded in Plessey, Westinghouse Brake, Aron Meter and Lancashire Dynamo, while there were a number of smaller improvements.

Electrical Investments

Company or Board	Nom. Value	Middle price 16th June	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1958 Highest	1958 Lowest
Electrical Shares—continued								
G.E.C. Ord.	£1	31/3		14	12½	—	38/9	29/3
G.E.C. 6½% Pref.	£1	20/-		6½	6½	6 10 0	21/3	20/3
General Cables	5/-	11/9		30	24	10 4 3	11/9	11/-
Greenwood & Batley	£1	47/3		17½	17½	7 8 3	48/-	45/-
Hackbridge Holdings	5/-	12/9		30	20	7 16 9	13/3	7/6
Hackbridge & Hewittic	5/-	12/-		23	20	8 6 9	12/-	9/7
Head Wrightson	5/-	21/9	+3d	22½	17½*	4 0 6	21/9	16/9
Heatrae	2/-	5/6		15	20	7 5 6	5/6	4/-
Henley's	10/-	11/-	−6d	11½	11½	10 9 0	14/6	10/6
Holophane	5/-	13/6		30	37½	8 6 9*	13/9	12/6
Hoover	5/-	42/6	+2/6	50	50	5 17 9	42/6	31/-
I.C.I.	£1	44/6	+3d	10	12	5 7 9	45/-	35/6
Ind. Combustion	5/-	23/6		22½	25	5 6 6	24/6	19/3
Johnson & Phillips	£1	19/3	−3d	10	5	5 4 0	25/-	15/-
Lancashire Dynamo	£1	38/9	+1/3	11	11	5 13 6	38/9	28/6
Laurence, Scott	5/-	14/3	+6d	15	15	5 5 3	14/9	12/6
Lister, R. A.	£1	24/6		10	10	8 3 3	26/3	23/-
London Elec. Wire	£1	44/6	+9d	12½	12½	5 12 3	44/6	39/6
Lucas, J.	£1	34/3	+1/3	7½	7½	4 7 6	34/3	27/9
Marconi Marine	£1	32/-		10	10	6 5 0	32/-	29/-
Marryat & Scott	2/-	12/3	+3d	30	35	5 14 3	12/3	10/3
Mather & Platt	£1	58/3		15	15	5 3 0	58/3	43/9
Metal Industries	£1	30/-xr		Nil	9	6 0 0	31/6	22/9
Midland Elec. Mfg.	£1	45/-		12½	12½	5 11 0	48/3	44/-
Morphy-Richards	4/-	15/6		50	20*	5 3 3	16/9	14/6
Murex	£1	55/-	+3d	20	20	7 5 6	57/6	53/3
Newman Ind.	2/-	2/3		10	10	8 17 9	2/9	2/3
Oldham & Son	1/-	2/6		17½	17½	7 0 0	2/7	2/3
Parnall (Yate)	5/-	13/-	−1/3	12	12	4 12 3	14/3	5/9
Parsons, C. A.	£1	46/6	+2/-	8½	7½*	3 4 6	53/6	43/-
Plessey	10/-	58/-	+1/-	30	30	5 3 6	59/-	55/-
Pye "A" Deferred	5/-	12/-	−6d	12½	12½	5 4 3	13/9	10/-
Reyrolle	£1	77/6		17½	17½	4 10 3	84/6	73/6
Rheostatic	4/-	6/-		12½	12½	8 6 9	8/-	6/-
Richardsons Westgarth	10/-	13/6	−6d	16⅔	8⅓*	6 3 6	15/-	13/-
Scottish Cables	4/-	13/3		27½	27½	8 6 0	13/9	12/3
Simon-Carves	5/-	25/6	+3d	20	25	4 18 0	27/9	22/6
Smith (England), S.	4/-	8/9	+3d	17½	20	4 11 6*	8/9	7/-
Southern Areas	£1	10/-		7½	Nil	Nil	13/9	9/6
Strand Elec.	5/-	4/9		15	15	15 15 9	6/3	4/9
Sturtevant	5/-	14/9		15†	15†	5 1 9†	18/-	14/9
Sun Elec.	£1	47/6		25	25	10 10 6	47/6	47/3
Switchgear & Cowans	5/-	11/6		25	22½	9 15 9	11/9	8/9
Taylor Tunnicliff	5/-	13/3		15	17½	6 12 0	13/9	11/9
T.C.C.	10/-	35/-		25	25	7 2 9	38/6	35/-
T.C. & M.	£1	23/-	−6d	8½	8½‡	7 7 9	27/-	20/-
Telephone Mfg.	5/-	5/3		10	10	9 10 6	5/3	4/6
Telephone Rentals	5/-	10/9		12½	12½	5 16 3	11/-	9/9
Thompson (John)	5/-	23/6		25	25	5 6 6	27/-	23/-
Thorn Elec. "A"	5/-	20/-		15	17½	4 7 6	20/-	17/-
Thornycroft	£1	25/9	+3d	12½	12½	9 14 3	27/9	21/-
Tube Investments	£1	55/-		13¾	15	5 9 0	55/-	48/3
Vactric	5/-	14/3	−3d	17½	25	8 15 6	15/6	14/3
Veritys	5/-	5/3		12½	12½	11 18 3	6/9	5/3
Walsall Conduits	4/-	14/-	+6d	20	22½	6 8 6	14/3	11/-
Ward & Goldstone	5/-	28/-	−6d	35	40	3 11 6*	28/6	23/6
Watford	2/-	7/6	+9d	25	25	6 13 3	7/6	5/-
Westinghouse	£1	40/-	+1/3	18	10*	5 0 0	40/-	32/3
West, Allen	5/-	10/6	−1/-	15	12½*	5 19 0	12/-	9/3
Wolf Electric	5/-	6/9		20	10*	7 8 3	9/-	6/9

Company News

Electric Construction £1 shares, at 23s 9d, were quoted 1s 3d higher after the appearance of the annual results and the declaration of a dividend of 8½ per cent, the rate paid since the 100 per cent scrip issue was made four years ago. The distribution is again comfortably covered by net profits, which improved moderately to £109,000, after tax, and which provides a yield of nearly 7⅛ per cent on the shares at their present price. Walsall Conduits 4s shares continued to be well supported after the publication of the full report, which indicates that expansion of turnover was responsible for the further improvement in earnings, despite smaller profit margins. The increase in sales in the home market is said to be continuing into the present year. Now 14s, the shares yield 6·4 per cent on the 22½ per cent dividend.

Allen West & Co.

At 10s 6d, the 5s shares of Allen West & Co. have lost part of the rise which followed the publication of the annual results, and are now showing a yield of nearly 6 per cent on the 12½ per cent dividend. This distribution represented an improvement of about 1 per cent on the previous payment, and was covered fully three times over by the increased surplus of profits. At the recently held annual meeting, the chairman made no prophecies. Orders on hand were slightly larger than they had been a year ago, but were harder to obtain, and he was uncertain about the extent to which difficult conditions in some sections might be offset by higher activity in others. It is the company's intention to start the payment of interim dividends about the end of November, and to give shareholders some indication of progress during the course of the year.

Plant for Goldfields

Mirrlees, Bickerton & Day, Ltd., have obtained an order from the Ashanti Goldfields Corporation, Ltd., for a type KVSS16 diesel engine developing 4,128 b.h.p. at 428 r.p.m. which will be direct coupled to a Brush 2,950 kW alternator.

REPORTS and DIVIDENDS

Allen West & Co., Ltd.—The annual meeting was held on 10th June, Mr. M. W. H. Lancaster (chairman) presiding. In his statement, which had been previously circulated, the chairman said that the group achieved a record turnover during the year under review. A further £200,000 had been spent on modernising equipment and they were about to extend their buildings by an office block which would house all the administrative offices. Factory No. 5 was nearing completion and would house a greatly extended research and development laboratory which would provide improved facilities for producing the heavy electrical powers needed to test their gear during development, so that they would have to go outside only for final test certification. The unexecuted order book was slightly higher than last year, but orders were harder to obtain.

Addressing the meeting, Mr. Lancaster said that the board had decided in future to pay interim dividends some time about the end of November each year.

Worthington-Simpson, Ltd. — Sir Samuel R. Beale (chairman) presided at the annual meeting held on 11th June. In his circulated statement the chairman said that incoming business for their standard products for the first quarter of the current year was higher than for the corresponding period of last year. In addition they had received the largest order in the history of the company, amounting to over £2 million, for condensing, feed-heating, evaporating and de-aerating plant, together with pumps and other ancillary equipment for a new power station at Buenos Aires. These two factors had the effect of causing their order book to stand at a higher level than ever before. During 1957 a new technical agreement was concluded with the Worthington Corporation of Harrison, N.J., U.S.A., for a period of ten years.

In order that the issued capital should more accurately reflect the actual amount invested in the business, it was proposed to make a free issue to ordinary shareholders of one new 10s ordinary share for every ordinary share held. The consent of the Treasury to the issue had been obtained. The directors saw no reason why at least the same total distribution should not be maintained.

Ferranti, Ltd., report group net profits for the year ended 31st March last of £575,971, as compared with £72,822 for 1956-57. The net profits are struck after taking into account a net loss of £170,617 sustained by overseas subsidiaries and after providing £677,000 for taxation. The ordinary dividend for the year is maintained at 6 per cent, general reserve receives £600,000 and capital reserve is increased by £5,000. The balance carried forward in the accounts of the parent company is £260,426 (against £218,025 brought in).

Walsall Conduits, Ltd.—The main figures in the accounts for 1957 were given in our last issue. In his circulated statement, Mr. C. G. Maisey (chairman) says that the figures for the year again constitute a record. It has been decided to modernise the Galvanising Department. An additional depot has been opened at Milford Haven and the depot at Bournemouth has been re-housed in larger premises. Sales in the home market for 1957, and also for the current year to date, continue to increase, but in consequence of currency restrictions and repercussions arising from the Suez crisis, the export business has declined.

The Mirrlees Watson Co., Ltd., reports that after releasing £45,964, unrequired taxation provision, the group profit for the year ended 31st March last amounted to £240,553, as compared with £227,736 for the preceding year. Taxation requires £129,157, and after deducting minority interests there is a net balance attributable to the holding company of £111,161 (against £114,316). Subsidiaries retain £23,790 and the parent company's net profit is £87,371 (£82,425). General reserve receives £25,000 and it is proposed to pay a dividend of 10 per cent and a bonus of 5 per cent, making 15 per cent for the year on capital increased by a one-for-two scrip issue. For the previous year the total distribution on the former capital was 20 per cent.

Falk, Stadelmann & Co., Ltd., have declared an interim dividend of 7½ per cent (unchanged). It is stated that the unchanged interim dividend does not indicate that the final dividend will be maintained.

Relay Exchanges, Ltd., announce that contracts have been exchanged for the acquisition of the capital of Goodman Industries, Ltd. The consideration will be satisfied by the allotment of 374,000 ordinary shares of 5s each in Relay Exchanges, credited as fully paid.

The Electric Construction Co., Ltd.—The group net profit for the year to 31st March last amounted to £109,014, as compared with £102,571 for 1956-57. Taxation absorbed £120,490. The dividend for the year is maintained at 8½ per cent.

Increases in Capital

Wild-Barfield Electric Furnaces, Ltd.—Increased by £40,000 in £1 ordinary shares, beyond the registered capital of £72,500.

Electrolux, Ltd.—Increased by £500,000 in £1 ordinary shares, beyond the registered capital of £2,500,000.

Berry's Electric Magicoal, Ltd.—Increased by £60,000 in 5s ordinary shares, beyond the registered capital of £375,000.

William Steward & Co., Ltd.—Increased by £15,000 in 9,396 ordinary and 5,604 unclassified shares of £1 each, beyond the registered capital of £20,000.

Electro-Mechanical Supplies, Ltd.—Increased by £11,000 in £1 ordinary shares, beyond the registered capital of £3,000.

Newey & Eyre, Ltd.—Increased by £50,000 in £1 ordinary shares, beyond the registered capital of £200,000.

George Ellison, Ltd.—We regret that in the notice under this heading in our issue of 9th May it was incorrectly stated that the increase in capital included 12,500 ordinary shares of £1 each. This should have read 125,000 ordinary shares. The company informs us that the registered capital is now £300,000 divided into 50,000 8 per cent cumulative redeemable preference shares of £1 each, 30,000 7 per cent cumulative participating preference shares of £1 each and 220,000 ordinary shares of £1 each.

Liquidations

A. & L. (Distributors), Ltd., electrical goods retailers, 25, Wormwood Street, London, E.C.2.—Winding up. Liquidator, Mr. F. H. Dymond, 37, Lewisham Way, New Cross, London, S.E.14, appointed 29th May.

H. G. Barnett & Partners, Ltd., radio and electrical engineers, 102, Talbot Road, Blackpool.—Liquidator, Mr. W. H. Meredith, Official Receiver and liquidator, 20, Byrom Street, Manchester, 3, released 29th May.

Bankruptcies

M. McS. Colgan, lately carrying on business as a radio, television and electrical dealer under the name of East Central Television Services, at 70, Leytonstone Road, E.15, 87, Roman Road, E.2, 133, Bethnal Green Road, E.2, and 39, Water Lane, E.15.—Trustee, Mr. N. W. Osborne, Bank Chambers, 1, John Street, London, W.C.1, appointed 2nd June.

W. J. K. Incledon, lately carrying on business at 203, West Derby Road, Liverpool, electrical engineer.—Trustee, Mr. S. O. Henry, 5, Rumford Place, Liverpool, 3, released 21st May.

K. Hanson, trading as Hanson's Electronics, at 2, Hall Street, Burnley, and 1, Parker Lane, Burnley, electrical engineer.—Last day for receiving proofs for dividend 20th June. Trustee, Mr. L. H. Shipton, 31, Lloyd Street, Manchester, 2.

E. H. Clegg, Brow Bridge, Greetland, near Halifax, electrical and television engineer.—Last day for receiving proofs for dividend 20th June. Trustee, Mr. G. E. Rushton, 36, North Parade, Bradford, 1.

J. R. Short, formerly carrying on business at 11, Rutland Avenue, Bishop Auckland, Durham, electrical contractor.—Third supplemental dividend of 1½d in the £, payable at the Official Receiver's office, Clarendon House, Clayton Street West, Newcastle-upon-Tyne, 1.

V. P. Jackson, 311-313, Aigburth Road, Liverpool, electrical and radio engineer.—Public examination 23rd September at the Court House, 5th Floor, India Buildings, Water Street, Liverpool, 2.

C. W. A. Hales, lately carrying on business at 2, Lake Road, Hamworthy, Poole, and at Robden, Hoyal Road, Hamworthy, Poole, as an electrical engineer.—Trustee, Mr. G. E. Radford, 12, Portland Street, Southampton, appointed 5th June.

A. J. Sweeny, 86, Albert Road, South Norwood, London, S.E.25, electrical contractor.—Last day for receiving proofs for dividend 24th June. Trustee, Mr. W. J. W. Hill, 58-61, York Terrace, Regent's Park, London, N.W.1, Official Receiver.

H. Smith, lately carrying on business as an electrical engineer at the Old Bakery, South Clifton, Notts.—Last day for receiving proofs for dividend. 24th June. Trustee, Mr. N. Temple, 185, High Street, Lincoln.

Mr. E. Webb, lately carrying on business at 10, Alderley Street, Macclesfield, Ches., as an agent for electrical appliances.—First and final dividend of 8d in the £, payable at the Official Receiver's office, 12, Lonsdale Street, Stoke-on-Trent.

GENERATION AND DEVELOPMENT

Boards' Domestic Appliance Sales

Increases in sales of all the main classes of electrical equipment are recorded in the latest quarterly return issued by the Electricity Council. The figures given in the accompanying table relate to new appliances sold by Area Boards in England and Wales for the month and twelve months ended 30th April last, together with percentage changes over the corresponding periods of 1957. It should be borne in mind that sales by Area Boards represent only a part of total sales throughout the country.

	Sales in month ended 30th April, 1958		Sales in 12 months ended 30th April, 1958	
Cookers	17,845	+ 2·5%	229,233	+ 6·5%
Water Heaters				
Immersion	14,755	+33·9%	145,917	+ 7·8%
Storage	3,631	+14·8%	42,572	+ 2·2%
Wash Boilers	6,556	+ 1·3%	79,678	+12·8%
Washing Machines ...	5,781	+ 5·5%	72,013	+ 4·8%
Refrigerators	4,943	+63·5%	51,882	+54·9%

Cable-Laying Across Scottish Lochs

As part of the North of Scotland Hydro-Electric Board's Kintyre and Cowall reinforcement scheme on the West Coast, submarine cables were recently laid across Loch Fyne from Otter Ferry to Port Ann, and across the Kyles of Bute. A crossing had also been made from Lochalsh to Skye. All these cables are connected to a 33 kV overhead land line. In the case of the Loch Fyne crossing, the use of submarine cables obviated a 62-mile inland route. The laying operations were carried out in April and May by Siemens Edison Swan, Ltd., who chartered the M.V. *Anno* for the purpose. The cables were manufactured at the company's Woolwich works on new plant installed specially to produce long lengths of cable.

Five cables were supplied. For Lochalsh-Skye a 0·1 sq in three-core oval H-type p.i.l.c. s.w.a. cable was manufactured to a length of 1,854 yd. For the Loch Fyne crossing three 0·1 sq in three-core round H.S.L. type cables were made each of 2,750 yd; and for the Kyles of Bute a length of similar cable measuring 2,000 yd. All these cables were manufactured in one continuous length with no factory-made joints; submarine cables of 33 kV size have not hitherto been made to such a length.

The overall diameter of the Lochalsh - Skye cable is 3·96in and the weight of the 1,854 yd is 47·62 tons. In the case of Loch Fyne and the Kyles of Bute the overall diameter is 3·73in; the weight of each 2,750 yd is 57·58 tons and the 2,000 yd cable weighs 41·87 tons.

Since the inception of the North of Scotland Hydro - Electric Board's development schemes, Siemens Edison Swan, Ltd., have laid six 11 kV submarine cables.

North Wales Nuclear Station Sites

The search for a suitable site in North Wales for a nuclear power station has cost £37,000, apart from the work of the Central Electricity Generating Board's own staff. This is stated in a memorandum which the Board has submitted to the Minister of Power (Lord Mills), who wanted further information about alternative sites before deciding on Trawsfynydd. The cost of examining the Trawsfynydd site alone was £4,000.

The report states that the whole of the coast of the Leyn Peninsula and of Merioneth has been examined. The first borings were begun in December, 1956, on a site at Llandwrog —an airfield about to become redundant. The site proved unsuitable. In February, 1957, work started on the three other coastal sites at Clynnog Fawr, Edern and Llanystumdwy. Consultations took place with officials of Merioneth County Council, during which the possibility of using the hydro-electric reservoir at Trawsfynydd as a source of cooling water was considered. It was found that this area would be suitable for a power station from the standpoint of planning and amenity.

The result of all the investigations was that of the sites listed only two—Trawsfynydd and Edern—were suitable. After considering all the factors, including the opinions of the County Councils and National Parks Commission, it was decided to proceed with the application to build at Trawsfynydd. Edern was a suitable site for a future station with a considerably greater output than Trawsfynydd.

Less Dust

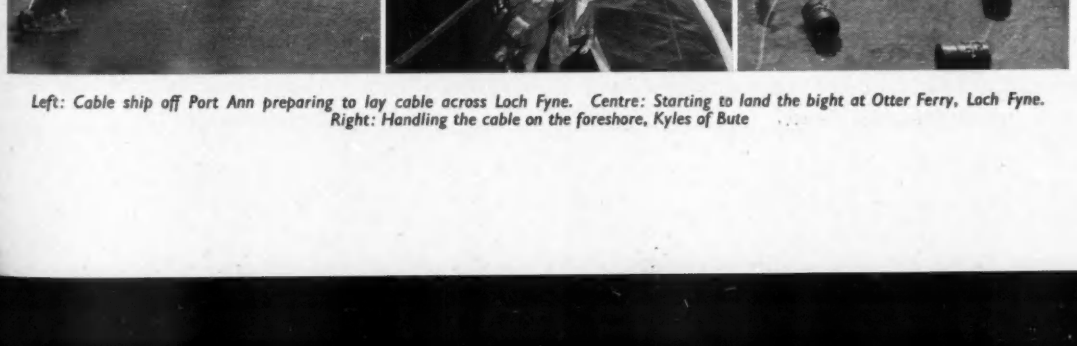
At a meeting of the Newburn (Northumberland) U.D.C. it was reported that during recent months there had been a reduction in the amount of dust discharged from the Stella power stations, due to alterations in the electrostatic precipitators and the use of better quality coal.

New Kingston Showrooms

The *Surrey Comet* reports that the South Eastern Electricity Board has leased a site at the corner of Eden Street and Clarence Street, Kingston-on-Thames, for the erection of showrooms.

Bradford Trolley-bus Extensions

A Provisional Order authorising Bradford Corporation to use trolley-vehicles on five additional routes has been made by the Minister of Transport and Civil Aviation and a Bill to confirm the Order has been published by H.M. Stationery Office (price 6d).



Left: Cable ship off Port Ann preparing to lay cable across Loch Fyne. Centre: Starting to land the bight at Otter Ferry, Loch Fyne. Right: Handling the cable on the foreshore, Kyles of Bute

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

2700. Electric & Musical Industries, Ltd. —Manufacture of cathode-ray tubes. 17th January, 1955. (796761.)

2701. Electric & Musical Industries, Ltd. —Method of releasing a vacuum in a vessel and evacuating apparatus. 17th January, 1955. (796762.)

6066. English Electric Co., Ltd.—Electric circuit-breakers of the gas-blast type. 25th February, 1955. (796581.)

19547. Cole, Ltd., E. K., and Hutchings, E. L.—Tone control in audio frequency amplifiers. 4th July, 1955. (796651.)

26573. National Research Development Corporation. — Waveguide phase-changing devices. 2nd September, 1955. (796652.)

32258. Parkes, E. L.—Swivelling coupler for electric wires and cables. 7th November, 1955. (796783.)

32442. Communications Patents, Ltd.—Wired broadcasting systems. 6th February, 1956. (796872.)

35854. Metropolitan Water Board.—Electrical measuring apparatus. 12th December, 1955. (796874.)

36004. Contraves Akt.-Ges.—Computing apparatus. 13th December, 1954. (796875.)

36022. Zenith Radio Corporation.—Subscription television system. 13th December, 1954. (796858.)

37182. Cabelka, J., and Horvath, S.—Method of manufacturing welding powders for electric submerged arc welding. 23rd December, 1954. (796688.)

1955

2662. Westinghouse Brake & Signal Co., Ltd., Walker, A. H. B., and Stevens, S. A.—Cooling of dry surface contact alternating electric current rectifier assemblies. 20th January, 1956. (796763.)

2663. Westinghouse Brake & Signal Co., Ltd., Thompson, L. E., and Walker, A. H. B. —Cooling of dry surface contact alternating electric current rectifier assemblies. 23rd January, 1956. (Cognate application 4118, 11th February, 1955.) (796764.)

10816. Siemens-Reiniger-Werke Akt.-Ges.—Ultrasonic impulse apparatus comprising transmitting and receiving components for measuring small impulse travel times. 14th April, 1955. (796600.)

11636. Welding Research, Inc.—Electrical converting system for supplying welding apparatus. 22nd April, 1955. (796786.)

12459. English Electric Co., Ltd.—Electric circuit-breakers of the gas-blast type. 25th February, 1955. (Divided out of 796581.) (796582.)

15471. Smith & Sons (England), Ltd., S. —Electrically-operated warning mechanism. 28th May, 1956. (796818.)

16419. Sutherland, T. S.—Electric mercury switches. 10th May, 1956. (796605.)

20625. M-O Valve Co., Ltd.—Thermionic valves having envelope apertures hermetically sealed. 6th July, 1956. (796884.)

25543. Soc. Anon. pour les Applications de l'Electricité et des Gaz Rares Etablissements Claude-Paz et Silva.—Low pressure mercury vapour electric discharge tubes for emitting light. 6th September, 1955. (796655.)

28633. Western Electric Co., Inc.—Circuits for the analysis and synthesis of speech currents. 7th October, 1955. (796676.)

31074. Philips Electrical Industries, Ltd. —X-ray apparatus supply or control circuits. 31st October, 1955. (796740.)

32262. Perkin-Elmer Corporation.—Device for the comparison of two beams of radiation by means of a phase-comparison system. 11th November, 1955. (796657.)

35766. Siemens & Halske Akt.-Ges.—Peak power measuring devices. 13th December, 1955. (796892.)

36214. Sylvania Electric Products, Inc.—Colour television circuit. 16th December, 1955. (796893.)

1956

1340. Automatic Telephone & Electric Co., Ltd.—Mounting arrangements for electrical components. 24th December, 1956. (796616.)

2749. Ateliers de Constructions Electriques de Charleroi.—Fluorescent lamps and powders. 27th January, 1956. (796658.)

3478. Telefonaktiebolaget L. M. Ericsson.—Multi-channel pulse signal transmission systems. 3rd February, 1956. (796895.)

5000. Standard Telephones & Cables, Ltd. —Method of producing selenium rectifiers. 17th February, 1956. (796896.)

7451. N.S.F., Ltd.—Electric switches. 11th March, 1957. (796622.)

12670. Zenith Radio Corporation.—Secrecy communication systems. 13th December, 1954. (Divided out of 796858.) (796859.)

14398. Telefunken Ges.—Methods of stirring molten electrically conductive material. 9th May, 1956. (796878.)

14924. Philips Electrical Industries, Ltd. —Television camera tubes. 14th May, 1956. (796900.)

16428. Standard Telephones & Cables, Ltd.—H.f. electrical wave guide coupling arrangement. 28th May, 1956. (796660.)

18410. Research Corporation.—Electrostatic precipitators. 14th June, 1956. (796624.)

21024. Horizons, Inc.—Electrolytic process for obtaining rare earth elements. 6th July, 1956. (796645.)

21339. General Motors Corporation.—Refrigerator. 10th July, 1956. (796626.)

21752. General Electric Co.—Silicone rubber adhesive sheet and tape materials. 13th July, 1956. (796911.)

23667. Fenwal Laboratories, Inc.—Dielectric heat sealing method and apparatus. 31st July, 1956. (796913.)

26862. Compagnie Générale de Télégraphie sans Fil.—Aerial systems. 3rd September, 1956. (796915.)

1957

5380. Electric Storage Battery Co.—Counter electromotive force cells. 18th February, 1957. (796849.)

9118. Imperial Chemical Industries, Ltd. —Formation of mechanical joints between electrical conductors. 20th March, 1957. (796650.)

28214. Western Electric Co., Inc.—Circuits for the analysis of speech currents. 7th October, 1955. (Divided out of 796676.) (796677.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 28th June:—

THERMOHM. No. 756,171. Class 9. Electrical pyrometers, electrical thermometers and electrical resistance elements for pyrometers and for thermometers.—Leeds and Northrup Co., Philadelphia, U.S.A. Address for service, c/o Mewburn Ellis & Co., 70-72, Chancery Lane, London, W.C.2.

UNIVAC. No. 769,260. Class 9. Electronic calculating apparatus and parts.—Sperry Rand Corporation, Wilmington, Del., U.S.A. Address for service, c/o F. J. Cleveland & Co., 29, Southampton Buildings, Chancery Lane, London, W.C.2.

SKY MONARCH. No. 769,348. Class 9. Radio receivers, television apparatus, gramophones, radio-gramophones, record players; and cases for electric torches.—Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7.

DEKATRON. No. 770,465. Class 9. Electronic discharge counting devices.—Ericsson Telephones, Ltd., 22, Lincoln's Inn Fields, London, W.C.2.

CAMPLEX. No. 772,151. Class 9. Thermostats.—Simplex Dairy Equipment Co., Ltd., Cintra House, 16, Hills Road, Cambridge.

NOCTURNE. No. 774,148. Class 9. Radio receivers and radio-gramophones.—Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.

MODAC. No. 774,473. Class 9. Electrical apparatus and instruments. — Modern Acoustics, Ltd., 2, Manor Way, Boreham Wood, Herts.

HAWKSLITE. No. 774,657. Class 9. Electric flat irons.—L. B. Parkes, trading as J. H. Hawkins & Co., "Never Trust" Works, Station Street, Walsall.

EKCO. No. 763,922. Class 11. Baths and parts; hot plates for food; and domestic electric space-heating apparatus and parts.—E. K. Cole, Ltd., Ekco Works, Priory Crescent, Southend-on-Sea.

ROTO CHEF. No. 770,605. Class 11. Cooking apparatus and installations.—Brattel Electric Co., Ltd., Arcade House, 27, Old Bond Street, London, W.1.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Tuesday, 24th June

LONDON. — Connaught Rooms, W.C.2, 12.30 for 1 p.m. Radio Industry Club. Luncheon.

Wednesday, 25th June

HOVE.—New Imperial Hotel, First Avenue, 6.45 p.m. A.S.E.E. Brighton, Hove and District Branch. Annual general meeting.

LONDON.—Royal Festival Hall, 7.30 p.m. Institution of Electrical Engineers. Conversazione.

Connaught Rooms, W.C.2, 12.30 for 12.55 p.m. Batti-Wallahs' Society. Luncheon. Guest speaker, Capt. R. H. J. Wallis of the cable ship *Alert*.

Thursday, 26th June

CROYDON.—Greyhound Hotel, High Street, 7.15 p.m. A.S.E.E. South London Branch. Annual general meeting.

LONDON.—Great George Street, Westminster, S.W.1. Institution of Civil Engineers. Conversazione.

Saturday, 28th June

CARDIFF.—Angel Hotel, Westgate Street, 7 p.m. A.S.E.E. South Wales Branch. Annual general meeting.

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Phosphor-Bronze, Nickel Silver, Brass, Copper & any ferrous or non-ferrous metals

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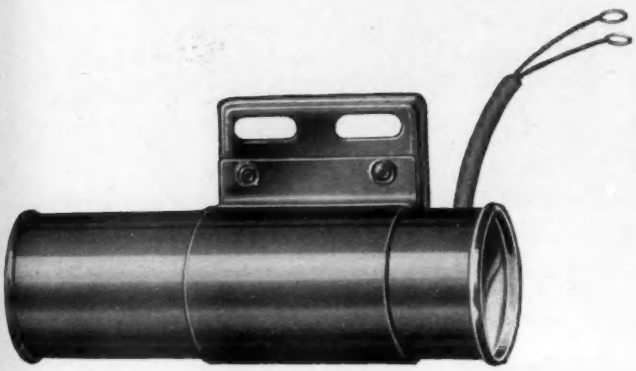
NON-STOP STARTING



Type TM3.

With this Dubilier Motor Starting Capacitor you can be sure of reliable starting every time. The capacitor element is hermetically sealed in an aluminium inner can mounted in a seamed metal outer casing with a strong mounting bracket designed to withstand a good deal of rough treatment.

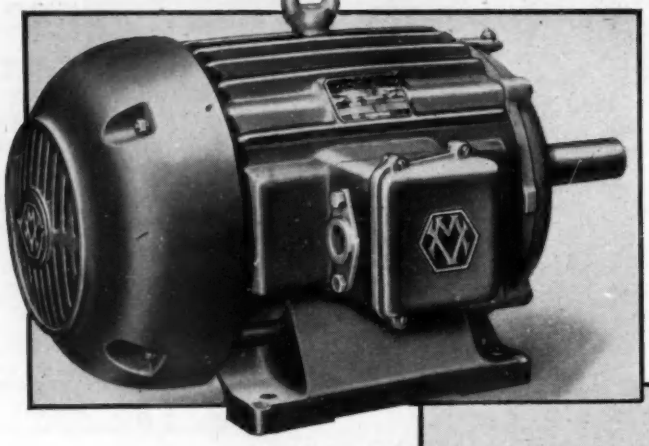
Available in three ranges of r.m.s. voltages—150V: from 160 to 280μF; 275V: from 65 to 130μF; 350V: from 50 to 100μF.

Reliable operation at temperatures up to 60°C.

Motor Start Capacitors by **DUBILIER**

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA RD., NORTH ACTON, LONDON, W.3. Phone: ACOrn 2241. Grams: Hilvoltcon Wesphone London.
DN 209

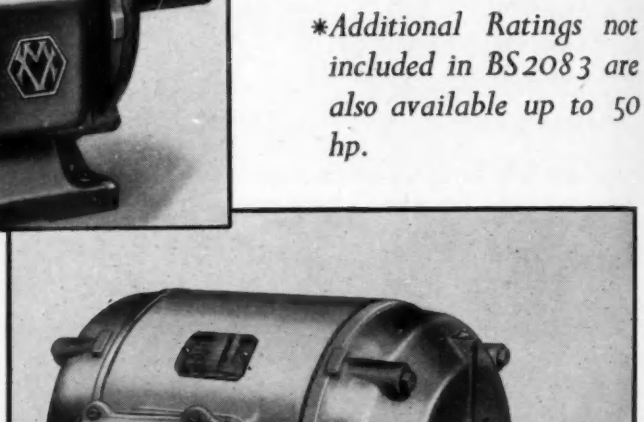
MOTORS *with Standardised Dimensions*



Type KN-B to BS2083/1956
TEFC ENCLOSURE
1-20 hp* (4-pole)

**Additional Ratings not included in BS2083 are also available up to 50 hp.*

With the introduction of the new BS2960/1958, squirrel-cage motors with Standardised Dimensions can now be supplied with VENTILATED as well as TEFC enclosures. Metrovick Motors designed and built to these specifications are known as Types KN-C and KN-B respectively.



Type KN-C to BS2960/1958
VENTILATED Enclosure from
1 to 40 hp (4-pole)

METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER 17

An A.E.I. Company

J/A801

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Australian Broadcasting Commission, Sydney, N.S.W. 23rd July. Television studio microwave link towers. (E.S.B. 14661/58. Ten/32911.)*

Burma.—Burma Purchase Board, Rangoon. 23rd June. Copper earthing clamps and "D" irons. (E.S.B. 14541/58. Ten/32882.)* 26th June. Insulators. (E.S.B. 14734/58. Ten/32904.)* Electric lamps and lampholders. (E.S.B. 14732/58. Ten/32925.)* Electric lamps, torch bulbs and projector lamps. (E.S.B. 14617/58. Ten/32906.)* Resistance wire, copper wire and d.c.c. wire. (E.S.B. 14731/58. Ten/32903.)*

Durham.—County Council. Electrical installation at Ryton New County Infants' School. (See this issue.)

East Retford.—R.D.C. 7th July. Two submersible borehole pumps, with electric motors, controls, etc. John H. Haiste & Partners, consulting engineers, Belmont House, 20, Wood Lane, Headingley, Leeds, 6.

Folkestone.—Corporation. 4th July. Trunk road lighting equipment. (See this issue.)

Formosa.—Central Trust of China, Taipei. 7th July. Insulators, line hardware and galvanised steel wire strand. (E.S.B. 14475/58. I.C.A. Ten/32815.)* 8th July. Aluminium cable, electrical fittings and hydraulic compressors. (E.S.B. 14477/58.I.C.A. Ten/32833.)* Power cable and indoor type potheads. (E.S.B. 14478/58.I.C.A. Ten/32836.)* 9th July. Copperweld ground rods, copperweld wire and accessories. (E.S.B. 14479/58.I.C.A. Ten/32873.)* Motor generators, batteries and rectifiers. (E.S.B. 14480/58.I.C.A. Ten/32824.)* 14th July. Lightning arrestors and air break switches. (E.S.B. 15032/58.I.C.A. Ten/32959.)*

Glanford Brigg. — R.D.C. 5th July. Duplicate sewage pumps, complete with motors, starter gear and accessories, for Scawby and Scawby Brook sewerage scheme. John H. Haiste & Partners, consulting engineers, Belmont House, 20, Wood Lane, Headingley, Leeds, 6.

India.—Bihar State Electricity Board, Patna. 7th July. Equipment and materials for Deoghar and Sultanganj substations. (See this issue.)

Damodar Valley Corporation, Calcutta. 17th July. Control panels and panels for on-load tap changers for the grid substation. (See this issue.)

Bombay State Electricity Board. 22nd July. Power and control cables and earthing materials for power stations and substations at Khaperkheda and Paras power stations. (E.S.B. 14492/58. Ten/32941.)*

Iraq.—Central Foreign Purchase Committee. 20th July. Locator beacons transmitters. (E.S.B. 14466/58. Ten/32901.)*

Manchester.—Housing Committee. 7th July. Electrical installations in 331 dwellings. (See this issue.)

New Zealand.—G.P.O., Wellington. 18th July. Meters. (E.S.B. 14718/58. Ten/32929)*

Tenders Board, Ministry of Works, Wellington. 15th July. Intake screen assemblies for the Ohahuri power project. (E.S.B. 14513/58. Ten/32949.)*

Oldbury.—Borough Council. 7th July. Removal of existing lanterns and control gear from 200 concrete columns, and supply, fitting and wiring of new sodium type lanterns and control gear on the Birmingham-Wolverhampton trunk road. Borough surveyor, Municipal Bank Chambers, Birmingham Road.

Porthcawl.—U.D.C. 25th July. Five sets of electrically driven vertical unchokeable sewage pumps and equipment, eastern area drainage contract No. 7. John Taylor & Sons, consulting engineers, Artillery House, Artillery Row, Victoria Street, Westminster, S.W.1.

Portuguese East Africa.—Permanent Purchasing Commission, Lourenço Marques. 30th June. One 78 kVA and one 30 kVA generating sets. (E.S.B. 14556/58. Ten/32880.)*

Reading.—Corporation. 8th July. Re-wiring of existing system at Wilson Secondary School. (See this issue.)

Rhodesia and Nyasaland.—Bulawayo Electricity Department. 2nd July. House service meters. (E.S.B. 14592/58. Ten/32855.)* Cable, copper conductors and cable joint boxes. (E.S.B. 14764/58. Ten/32932.)* 16th July. Overhead line and service materials. (E.S.B. 14594/58. Ten/32845.)*

South Africa.—Cape Town Electricity Department. 14th August. Boiler plant, steel frame building, turbo-alternators, condensing plant, piping equipment including boiler feed pumps for Athlone power station. (E.S.B. 14405/58. Ten/32800.)*

Union Tender and Supplies Board, Pretoria. 3rd July. Radio equipment, spares and generating plants. (E.S.B. 14562/58. Ten/32828.)*

Stores Department, South African Railways, Johannesburg. 2nd July. One 3-unit switchboard. (E.S.B. 14673/58. Ten/32877.)* Telegraph line material (insulators and spindles). (E.S.B. 14578/58. Ten/32848.)* 4th July. Lighting fittings. (E.S.B. 14579/58. Ten/32853.)* 9th July. Two 9 kVA diesel alternators. (E.S.B. 14674/58. Ten/32885.)* Underground armoured cable. (E.S.B. 14580/58. Ten/32854.)* Weatherproof automatic telephones. (E.S.B. 14675/58. Ten/32878.)* 11th July. Electric lamps. (E.S.B. 14677/58. Ten/32876.)* Aluminium radio aerial masts. (E.S.B. 14676/58. Ten/32892.)*

Johannesburg City Council. 30th June. Electrically driven centrifugal pumping sets with ancillary equipment. (E.S.B. 14678/58. Ten/32875.)*

Sudan.—Stores Department, Sudan Railways. 22nd July. A.c. motors. (E.S.B. 14902/58. Ten/32922.)*

Thailand.—Ministry of Defence, Bangkok. 21st July. Two 100 kW generating sets. (E.S.B. 14754/58. Ten/32924.)*

Vietnam.—Central Purchasing Authority, Saigon. 9th July. Radio transmitters and receivers. (E.S.B. 14586/58.I.C.A. Ten/32861.)* Generators, battery chargers and voltage regulators. (E.S.B. 14585/58.I.C.A. Ten/32862.)* Antennæ, radio transmitters and receivers. (E.S.B. 14584/58.I.C.A. Ten/32863.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Douglas (I.O.M.).—Corporation Electricity Committee. Recommended. Two 2,000 kW diesel generators for Pulrose power station (£122,039).—Mirrlees, Bickerton & Day. One 750 kVA transformer (£1,220).—English Electric Co.

London.—L.C.C. Renewal and improvement of electrical installation at St. Marylebone Grammar School, Paddington (£6,785). —Drake & Gorham (Contractors), Ltd. Renewal of electrical installations in 712 dwellings and alterations to the public lighting system at Downham Estate, Bromley, Kent (£21,731).—Holliday & Son (Electrical), Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Birmingham.—Works and offices, Hospital Street; Hughes Lathbury, Ltd., 44, Howard Street.

Birtley (Co. Durham).—Offices for H. N. Marsh & Co.; Newrick & Blackbell, architects, 58, John Street, Sunderland.

Brighton.—Flats and maisonnettes, Chatsworth Road; Amaland Properties, Ltd., 26/7, Regency Square.

Bury.—Flats and bungalows (146), Bolton Road estate; J. Chadwick, borough engineer, Bank Street.

Cardiff.—Extensions to Welsh College of Advanced Technology (£625,000); J. Gerrard & Sons, Ltd., builders, Swinton, Manchester.

Carlisle.—Business premises on site of former Kingstown Airport for Harrison & Hetherington, Ltd., Botchergate, Carlisle.

Houses (60), Morton estate; L. J. A. Stow, city engineer, 18, Fisher Street.

Chelmsford.—Reorganisation of Mid-Essex Technical College (second contract, (£42,000); A. R. Dannatt & Son, architects, 65a, Duke Street, Chelmsford.

Cheltenham.—Large shopping centre, Arle and Hesters Way area, including offices, banks, church and residential accommodation; Morgan & Branch, architects to developers, Charterhouse Square, London, E.C.1.

Houses and bungalows (73), Benhall Farm estate; Geo. Wimpey & Co., Ltd., 15, Royal Crescent.

Cheshunt.—Three-storey buildings consisting of shops, flats and offices, College Road and Turners Hill; G. Newnham, clerk to U.D.C., Manor House, Waltham Cross.

Chester-le-Street.—Factory additions for Caterpillar Tractor Co., Ltd.; Wright & Kellett, Ltd., contractors, Ashley Terrace.

Coatbridge. — Factory at Shawhead; McKinnon & Co., Ltd., Montrose Works, Carfin.

Coseley.—Houses (92), blocks of flats and four shops, Spring Road site; J. C. Roper, clerk, Urban Council House.

Dalkeith.—Health centre for Midlothian C.C.; county architect, 32, Palmerston Place, Edinburgh.

Dewsbury.—Secondary technical school; R. W. Gregory & Partners, electrical consultants, 1, Brazennose Street, Manchester, 2.

Dorchester.—Houses (100) for U.K. Atomic Energy Authority; L. Magnus Austin, architect, Bowling Alley Walk.

Dunbarton.—Divisional police headquarters in Main Street, Milngavie; county architect, Radnor Park School, Clydebank.

Dunstable.—Occupation centre at Poynters Road; S. Goodman, county architect, Shire Hall, Bedford.

Ealing.—Office block, 57/9, Uxbridge Road; General Housing Co., Ltd., 55, The Mall, W.5.

Easington.—Houses (150); R.D.C. surveyor.

Edinburgh.—Houses (528), Ferry Road development; A. Steele, city architect, City Chambers, High Street.

Glasgow.—Houses (54), Riddrie Knowes; director of housing, 20, Trongate.

Gorleston-on-Sea.—Bridge Road Secondary Modern School; F. Jackson, schools architect, 22, Euston Road, Great Yarmouth.

Gorseinon.—Press and fabricating works; Richard Thomas & Baldwins, Ltd., Ebbw Vale, Mon.

Greenford.—Synagogue, Oldfield Lane;

Henry Darsa, architect, 59a, Cennaught Street, London, W.2.

Hebburn-on-Tyne.—Houses (200), Elmfield estate and in Toner Avenue; U.D.C. surveyor.

Hebden Royd.—Houses (48), Dodmaze; surveyor, 14, The Exchange, Bradford.

Huntingdon.—Additional factory for Silent Channel Co., Ltd., Main Road; G. B. Brudenell, Ltd., builders, 6, Orchard Way, Godmanchester.

Kiveton Park.—Houses (388), High Moor estate; W. M. Gibson, surveyor, 78, Lidgett Lane, Dinnington, Rotherham.

Lancashire.—Library, Tithebarn Street/Hall Green site, Upholland, and county secondary school, Shevington; county architect, County Offices, Fishergate Hill, Preston.

Larkhall.—Remodelling of Union Street School and annexe, including the erection of a new school meals kitchen; Ian Paterson, clerk to C.C., 191, Ingram Street, Glasgow, C.1.

Leamington Spa.—Factory, Queensway estate; Silverknight Trailers, Ltd., 98, Warwick Street.

Leeds.—Showrooms and offices, Vicar Lane; S. B. Harbour, 43, Grosvenor Square, London, W.1.

London.—Rebuilding Stormont House School, Hackney (£70,000); H. Bennett, Architects' Department, County Hall, Westminster Bridge, S.E.1.

Thirteen-storey offices with ground floor restaurant, Chiltern Street and Paddington Street area; R. Seifert, architect, 28, Great Ormond Street, W.C.1.

Chapel, Roehampton Lane, Wandsworth (£70,000), for Digby-Stuart Training College; L. H. Shattock, architect, 4, Crescent Road, Wimbledon, S.W.20.

Offices, 25/28, Old Burlington Street, Mayfair; Gollins, Melvin, Ward & Partners, architects, 15, Manchester Square, W.1.

Offices, 231/33, Gower Steeet, St. Pancras; Wates, Ltd., builders, 1258, London Road, S.W.16.

Mendlesham.—Television station for I.T.A.; E. R. Collister & Associates, architects, 70, Victoria Street, London, S.W.1.

Middlesbrough.—Four-storey departmental store, Linthorpe Road, for Brador Estates, Ltd.; North & Partners, architects, 40, Broadway, Maidenhead.

Ice cream factory, Pilkington Street, for G. Crolla; T. A. Crawford, architect, 80, Borough Road.

Private housing estate near The Avenue; Cussins, Ltd., contractors, The Drive, Gosforth.

Musselburgh.—Houses (34), Pinkie Braes; Scottish Special Housing Association, Ltd., 15-21, Palmerston Place, Edinburgh, 12.

Newcastle-on-Tyne.—Flats (141), Castle Ward rural area; city architect, 18, Cloth Market.

Newport (Essex).—Grammar school extension; Clifford Culpin, architect, 39, Doughty Street, London, W.C.1.

Newton Aycliffe.—Shops and offices in town centre (£54,000); Aycliffe Development Corporation.

Northwood.—Maisonnettes (56), Green Lane; A. E. A. Prowting, Ltd., 127, High Street, Ruislip.

Oakengates.—Offices, printing works, etc., Bridge Street; F. V. Pendlebury, printer, 17, Gower Street, St. Georges.

Peterlee (Co. Durham).—Three-storey block of nine shops and maisonnettes for Peterlee Development Corporation; W. J. Scott, chief architect.

Rickmansworth.—Works extensions; Colne Valley Sewage Board, Maple Lodge.

Rochdale.—Dwellings (343), Meadway estate, Marland; Geo. Wimpey & Co., Ltd., builders, 629, Eccles New Road, Salford.

St. Albans.—Factory and offices; A. Arenson, Ltd., Park Road, Barnet.

Saltburn.—Houses (150), Hob Hill; R. Stroughair, surveyor, Albion Terrace, Saltburn, Yorks.

Seaton Valley (Northumberland).—Houses (14), Seghill; T. W. Burgess, surveyor, Council Offices, Seaton Delaval.

Southend-on-Sea.—Transport depot, Tunbridge Avenue; borough architect.

South Shields.—Factory extension, River Drive, for Tyne Chemical Co.; Alston Limestone Co., Ltd., contractors, Westgate Road, Newcastle-on-Tyne.

Infants' school, Galsworthy Road; J. Smeds, architect, 56a, Camden Street, North Shields.

Houses (198), King George Road; Smiths Gore & Co., surveyors, Darlington.

Stalybridge.—Works extensions; Range Boilers, Ltd., Bridge Street.

Stanley.—Civic hall, Front Street (about £40,000); J. Hustwit, U.D.C. surveyor, Coach Road, Outwood.

Stirling.—Three blocks of police houses, Cecil Street, for Joint Police Board; clerk to the Board, Viewforth, Stirling.

Stockport.—Municipal hostel for 250 persons; J. Rank, borough architect.

Stratford-on-Avon. — Showrooms and offices; Healing & Overbury, architects, Rodney Lodge, Cheltenham.

Sunderland.—Houses in Corporation Road (62), Howick Street (76), Azalea Terrace (84), and on the Grindon Village estate (298); H. C. Bishop, borough architect, Grange House, Stockton Road.

R.C. junior school at Grindon; borough architect.

Swansea.—Works extensions; F. W. Berk & Co., Ltd., Pentrepoeth Chemical Works.

Thorne.—Houses (28), South Common estate; R.D.C. architect, Thorne, Yorks.

Wallsend.—Twelve-storey blocks of flats; C. E. Faddy, borough engineer.

Walthamstow.—Factory, Blackhorse Lane; A. Boake Roberts & Co., Ltd., Carpenters Road, London, E.15.

Welwyn Garden City.—Works and laboratories for Smith Kline & French Laboratories, Ltd.; Wm. Sindall, Ltd., builders, Gloucester Street, Cambridge.

Weston-super-Mare. — Divisional fire brigade headquarters for County Fire Brigade Committee; R. O. Harris, county architect, Park Street, Taunton.

Willenhall. — Corpus Christi Primary School; W. H. Saunders & Son, architects, 23, Eaton Road, Coventry.

Williton.—Houses (50), Stogursey, for atomic power station employees; surveyor, Council Offices, Fore Street, Williton, Somerset.

Wiltshire.—Junior county school, Lower Stratton; county architect, County Hall, Trowbridge.

Winsford.—Secondary modern school, first instalment (£50,000); county architect, County Hall, Chester.

Wythenshawe.—General hospital; Powell & Moya, architects, 36, Great Smith Street, London, S.W.1.

CATALOGUES AND LISTS

CABLES.—Booklet (538) showing applications of the company's metallic flexible armoured cable in industry.—**W. T. Henley's Telegraph Works Co., Ltd.,** 51-53, Hatton Garden, London, E.C.1.

24-page catalogue dealing with a range of low voltage power cables for use in air, installation in buildings, ducts, or direct burial in the ground.—**Mersey Cable Works, Ltd.,** Linacre Lane, Bootle, Liverpool, 20.

CONTACTORS. — Illustrated leaflets (AC.201 and AC.204) giving details of Series GL triple pole a.c. air-break contactors.—**William Geipel, Ltd.,** Vulcan Works, Bermondsey Street, London, S.E.1.

CONTROL EQUIPMENT. — Leaflets (353/458 and 159) dealing with a servo-motor and the company's "Mark 30" pneumatic control system.—**George Kent, Ltd.,** Luton, Beds.

DETARRERS.—Brochure (74) describing the "Holmes-Elex" electrical detarrers for the removal of tar fog from manufactured gas.—**W. C. Holmes & Co., Ltd.,** P.O. Box No. B7, Turnbridge, Huddersfield.

ELECTRIC MOTORS.—Illustrated catalogue (DM/239) giving particulars of the "C" range of squirrel-cage ventilated continuously rated motors to British Standard dimensions, and leaflets dealing with the ½ h.p. "Magamp" motor control unit and a 3 h.p. motor controller giving stepless variation of speed.—**English Electric Co., Ltd.,** Bradford.

20-page price list (108N) giving particulars of a.c. motors and control gear.—**Laurence, Scott & Electromotors, Ltd.,** Norwich.

FURNACES.—12-page catalogue (R.F. 6.58) dealing with electric furnaces, designed and built for individual and particular requirements.—**Royce Electric Furnaces, Ltd.,** Sir Richard's Bridge, Walton-on-Thames, Surrey.

NUCLEAR POWER.—Booklet entitled "The Nuclear Power Station" which describes the importance to British industry of the development of nuclear power, explains the structure of the nuclear power industry and illustrates the way in which a nuclear power station differs physically from a conventional station.—**Wakefield-Dick Industrial Oils, Ltd.,** 67, Grosvenor Street, London, W.1.

Illustrated brochure (ES/132) describing a nuclear reactor simulator which has been developed by the company's Control and Electronics Department.—**English Electric Co., Ltd.,** Kidsgrove, Stoke-on-Trent.

OIL MIST DETECTOR.—Descriptive booklet on the company's diesel engine crankcase oil mist detector equipment which has been developed to give warning of an increase in the formation of oil mist before a dangerous condition can be reached.—**Graviner Manufacturing Co., Ltd.,** Fareham Road, Gosport, Hants.

RECTIFIERS.—Brochure (RS/124) on rectifier equipment to provide industrial d.c. supplies of up to 200 A and 600 V, and a booklet (RS/125) dealing with germanium rectifier equipment.—**English Electric Co., Ltd.,** Stafford.

SEMICONDUCTORS.—Looseleaf booklet containing data sheets on the range of Ediswan "Mazda" transistors.—**Siemens Edison Swan, Ltd.,** 155, Charing Cross Road, London, W.C.2.

SPACE HEATING.—Illustrated broadsheet giving particulars and latest prices for the "Unity" range of space heating equipment.—**Unity Heating, Ltd.,** Chilworth Manor, Southampton.

SWITCHGEAR.—Three publications dealing respectively with e.h.v. air-blast circuit-breakers (SG/250), open type substation fusegear (FG/134) and "Red Spot" heavy duty fuseboards (FG/138).—**English Electric Co., Ltd.,** Stafford.

Leaflet (I.S.P.2) giving information on high voltage outdoor rocking type isolating switches for use on voltages up to and including 88 kV.—**Line Equipment, Ltd.,** 32, Queen Victoria Street, London, E.C.4.

TELEPHONES. — Leaflet (1268/ATE) describing and illustrating in colour the company's Type 332 telephone instrument which is available in red, ivory, and jade green to harmonise with colour schemes.—**Automatic Telephone & Electric Co., Ltd.,** Strowger Works, Liverpool, 7.

TOOLS.—Series of five leaflets giving particulars of the "Hilti" tools for fastening nails, threaded studs and fixing pins into concrete, brickwork or iron girders by means of blows from an ordinary club-hammer.—**Ucan Development, Ltd.**—Dome Buildings, The Quadrant, Richmond, Surrey.

WIRING ACCESSORIES.—40-page illustrated and priced catalogue (W940) giving particulars of the "Wylex" range of switches, plugs and sockets, cooker units and switchfuse control units.—**George H. Scholes & Co., Ltd.,** Wylex Works, Wythenshawe, Manchester, 22.

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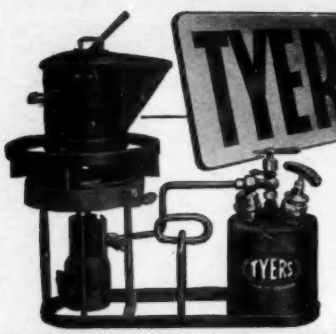

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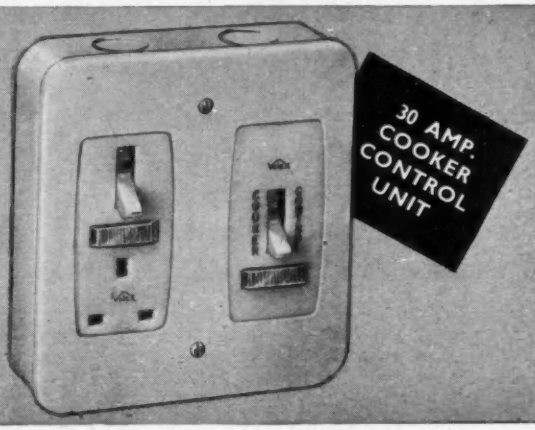

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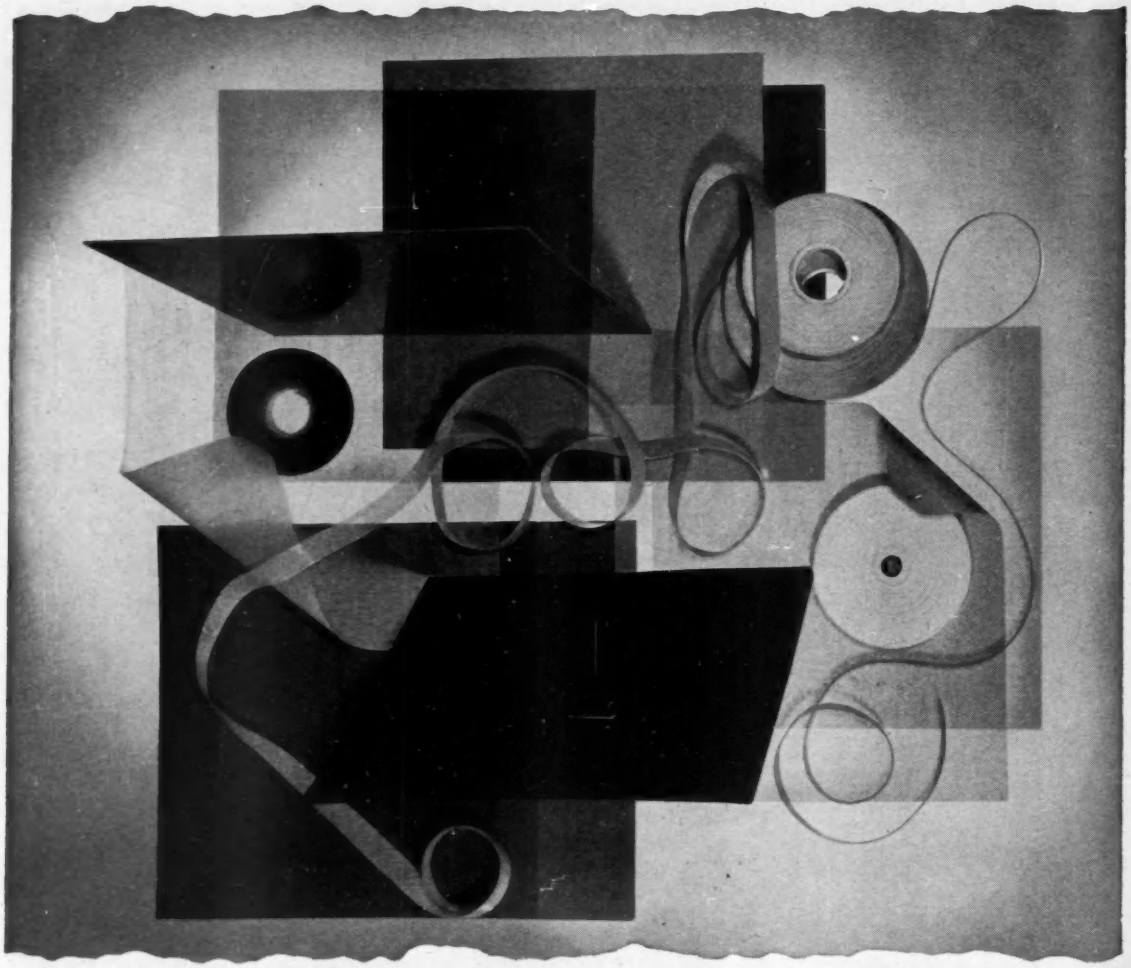

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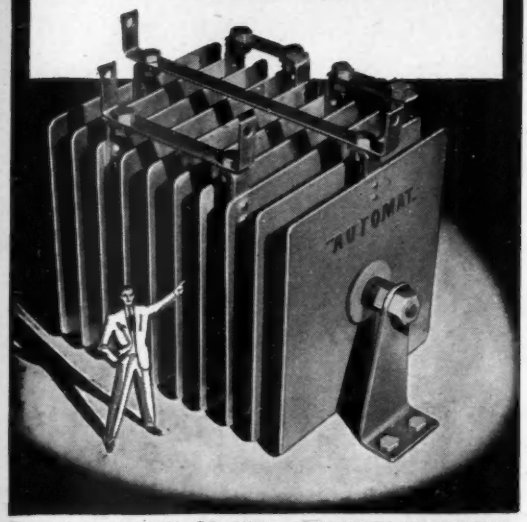

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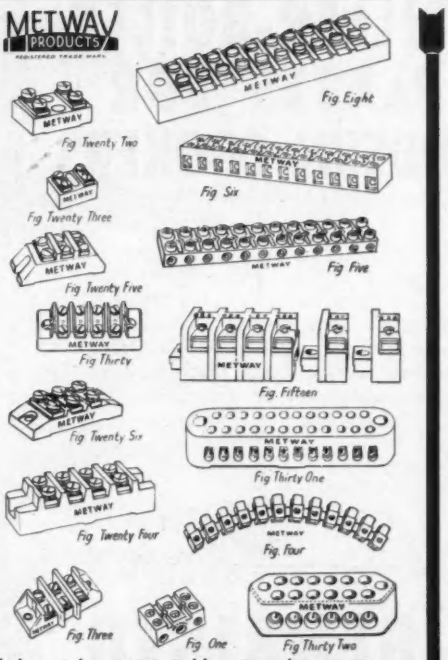

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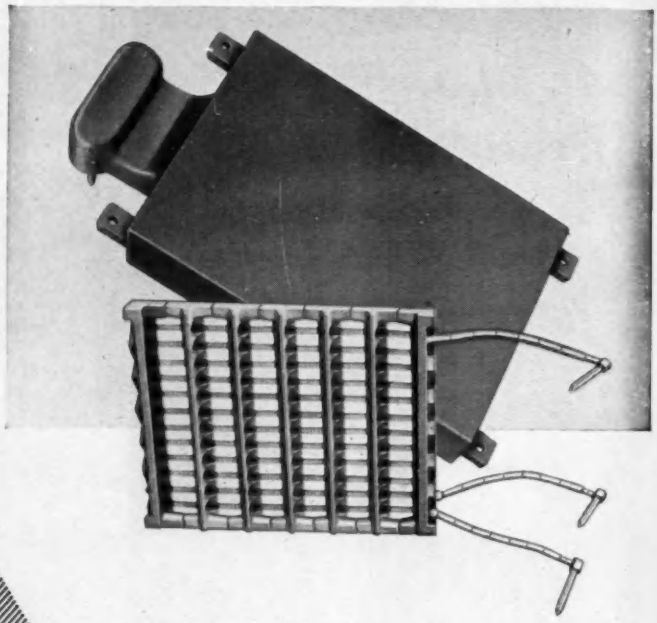

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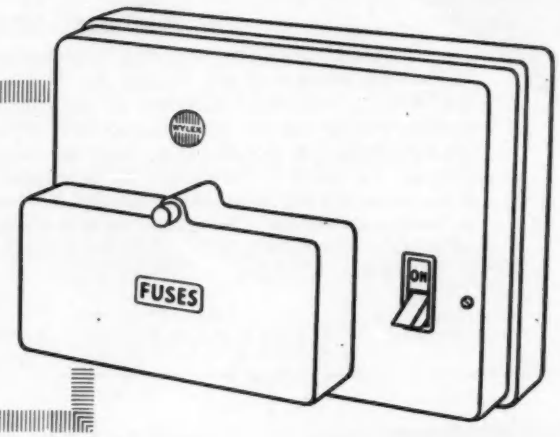

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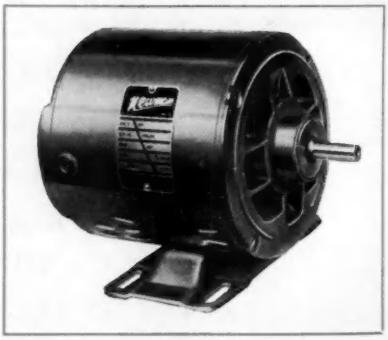

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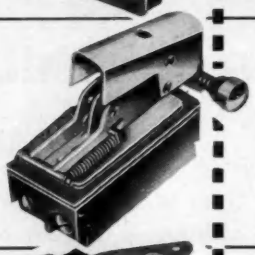

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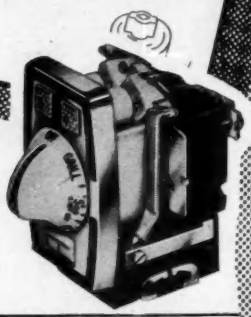

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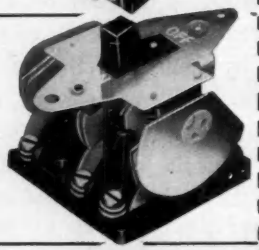

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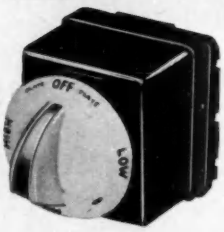

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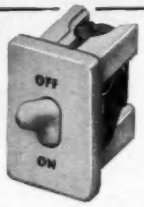

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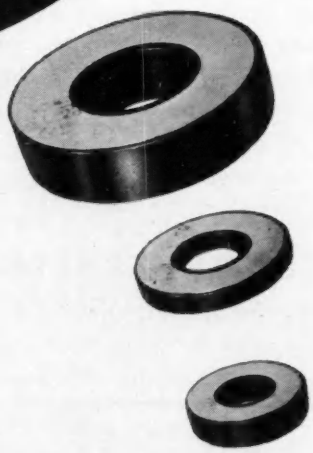

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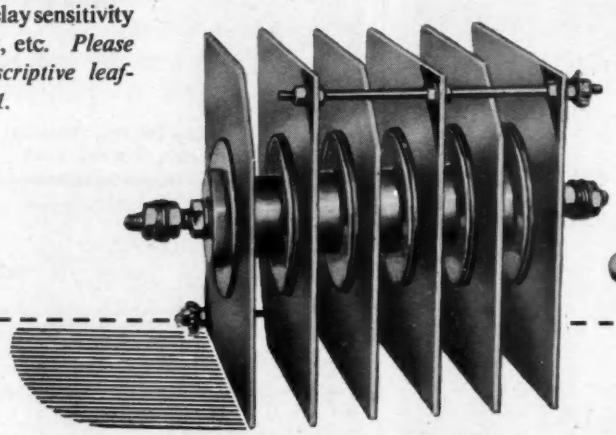

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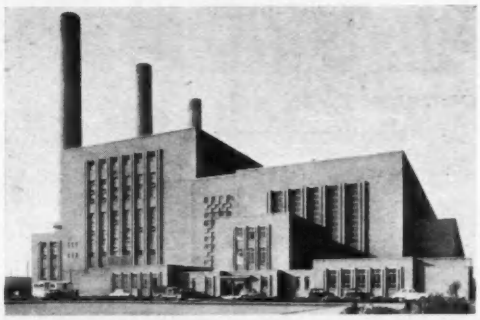

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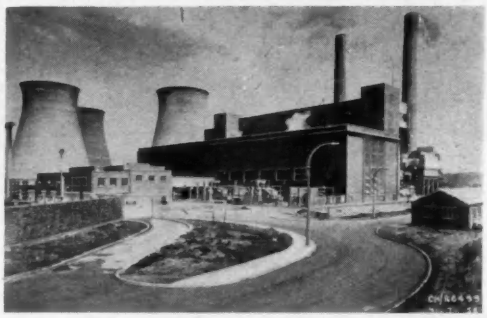

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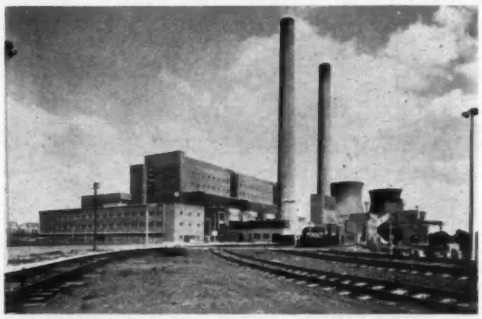

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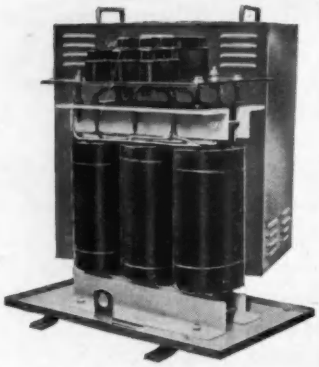

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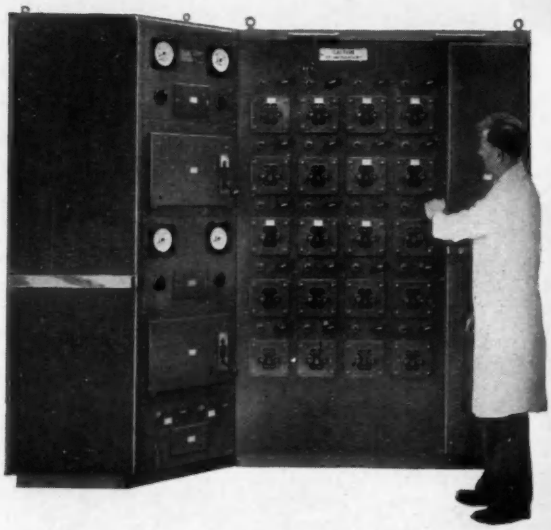

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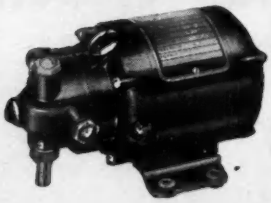

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300	16 oz. in.	25	4 lb. in.
150	24 oz. in.	18.8	4 lb. in.
100	32 oz. in.	12.5	4 lb. in.
75	36 oz. in.	9.4	4 lb. in.
50	3 lb. in.	6.25	4 lb. in.

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R.P.M.	TORQUE	R.P.M.	TORQUE
216	4 oz. in.	13.5	24 oz. in.
108	7 oz. in.	9	30 oz. in.
54	10 oz. in.	6.7	35 oz. in.
36	12 oz. in.	4.5	44 oz. in.
27	15 oz. in.	3.35	3 lb. in.
18	20 oz. in.	2.25	4 lb. in.

VARIABLE SPEED GEARED MOTOR—Type 'KQ'

R.P.M.	TORQUE	R.P.M.	TORQUE
200-600	9 oz. in.	12-37.5	4 lb. in.
100-300	16 oz. in.	8-22	4 lb. in.
50-150	20 oz. in.	6-16.5	4 lb. in.
32-100	32 oz. in.	4-11	4 lb. in.
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16- 50	48 oz. in.	2- 5.5	4 lb. in.

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228	13 oz. in.	19	4 lb. in.
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57	32 oz. in.	7.1	4 lb. in.
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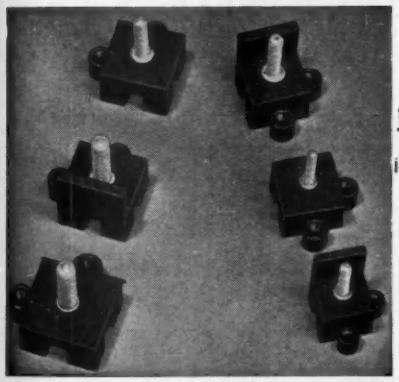

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for earthing cables up to	7/0.036"	7/0.064"	19/0.064"	19/0.083"
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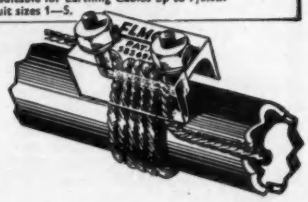

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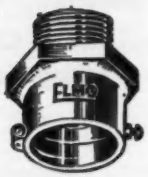
Electric Thread (Male)	⅜"	½"	1"	1¼"	1½"	2"
Inside Diameter	⅜"	½"	1"	1¼"	1½"	2"
Electric Thread (Male)		⅜"	½"	1"	1¼"	
Inside Diameter Flexible Conduit		½"	⅝"	⅞"	1"	

WITH EARTHING TERMINAL



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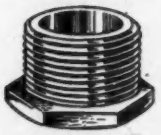

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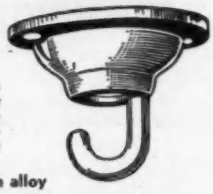

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PRICES **DOWN**

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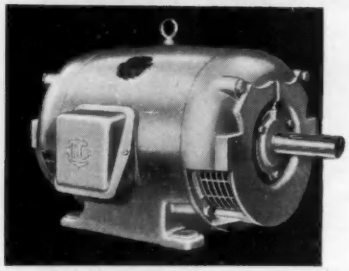
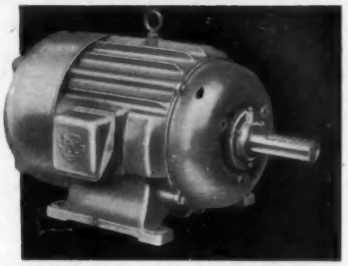


A.C. up to 50 h.p. to B.S.2960

T.E. FAN-COOLED



A.C. up to 25 h.p. to B.S.2083

Lists B.25 and B.35, giving full details of the above motors respectively will be sent on request.

LANCASHIRE DYNAMO & CRYPTO LTD

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A MEMBER OF THE LANCASHIRE DYNAMO GROUP

The Symbol of Power and Service for over 50 years

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CROYDON
announce a NEW
illustrated brochure on F.H.P. MOTORS

Write Today

The comprehensive range of F.H.P. motors we manufacture is fully described in this latest brochure

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THE CROYDON ENGINEERING CO. LTD., COMMERCE WAY, PURLEY WAY, CROYDON

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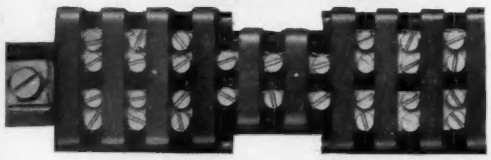
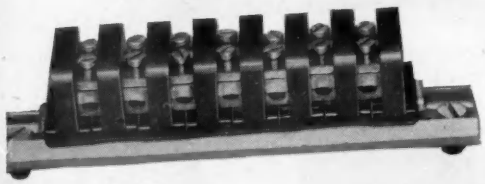
"Colne" CONNECTORS

Range 25 to 50 ampere capacity. Unit build up from 2 way to 26 way strips, in either 25 amp., 50 amp. or mixed assemblies.

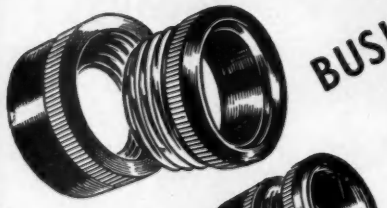
We invite your enquiries.





Manufactured by

Colne **SWITCHGEAR (K & W) LTD.**
formerly Electrical Products (Colne) Ltd.
Walton Street, Colne, Lancs.
Phone: Colne 1394/5



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Conduit
B.S.P.
26 T.P.I.

Litholite Plastic Moulders since 1901

LITHOLITE Insulators & St. Albans MOULDINGS LTD.
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THE NEW BKS

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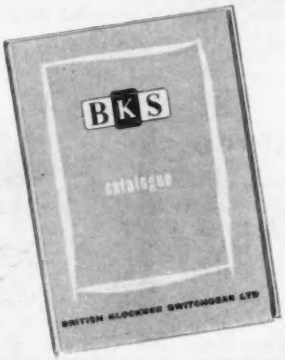

electrical control equipment catalogue

This new catalogue gives full technical data, dimensions and prices for the current range of British Klockner Switchgear Electrical Control Equipment.

- ★ Direct-on-line Starters
- ★ Reversing Starters
- ★ Auto Star-Delta Starters
- ★ 2-Speed Motor Starters
- ★ Auto Transformer Starters
- ★ Auto Stator-Rotor Starters
- ★ Contactors
- ★ Thermal Overload Units
- ★ Push Button and Remote Control Stations
- ★ Limit Switches and Rotary Switches

This catalogue will be sent FREE on request

BRITISH KLOCKNER SWITCHGEAR LTD
HEAD OFFICE AND WORKS: **CHERTSEY, SURREY**
Telephone : Chertsey 2067. Telegrams : Switchgear, Chertsey

SALES OFFICES :

LONDON	Refer to Head Office
MANCHESTER	Cromford House, Cromford Court Tel.: Blackfriars 3903
GLASGOW	249 St. Vincent Street. Tel.: Central 2479
NEWCASTLE	4 Beechwood Avenue, Monkseaton, Whitley Bay Northumberland. Tel.: Whitley Bay 24231
BIRMINGHAM	190 Aldridge Road, Streetly, Staffordshire Tel.: Streetly 1641
DUBLIN	11 Crow Street, Dublin. Tel.: Dublin 71717

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To British Klockner Switchgear Ltd., Chertsey, Surrey
Please send me your latest comprehensive catalogue

NAME .....
POSITION .....
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ER/6/58

Flawless

No, we shall not be silly and claim that our castings are as flawless as a piece of 16th century Venetian Glass. But we can go this far: we can say that just as the old master craftsmen got great satisfaction out of doing a job as well as it could possibly be done, so do we. That is why so many customers whose castings must have a fine skin which will readily anodise put their trust in Great Bridge Foundries

PRECISION CASTINGS IN ALUMINIUM, GUN METAL, GREY IRON, ETC. TO ALL SPECIFICATIONS

Phos. bronze and gun metal solid and cored sticks always in stock

THE GREAT BRIDGE FOUNDRY CO. LTD.

Sheepwash Lane Great Bridge - Tipton
Staffordshire Telephone TIPton 1540 and 1361

A MEMBER OF THE TRIPLEX FOUNDRIES GROUP

THE SIGN OF A GOOD CASTING

Insist on
T.E.C.

POWER AND DISTRIBUTION TRANSFORMERS TO 100 kVA. LOW VOLTAGE FLASH TEST AND RECTIFIER UNITS. METAL WORK. LIGHT ASSEMBLY. SLOTTED ANGLES AND TRANSFORMER & ELECTRICAL REPAIRS

THREE PHASE OIL COOLED UP TO 100 K.V.A.

Leaflets on request—
The TRANSFORMER & ELECTRICAL CO. LTD.
HONYWOOD RD., BASILDON, ESSEX
Telephone: Basildon 20491/3

INSULATING SHROUDS FOR LINE TAPS
TO B.E. SPECIFICATION

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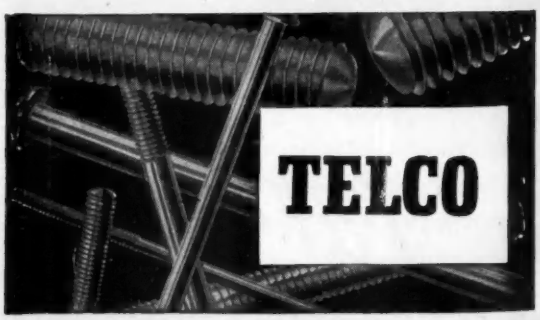
PHENOLIC AND UREA

T. BLACKWELL & SON LTD. *Phone: Waltham Cross 2430*
Brooker Road, Waltham Abbey, Essex



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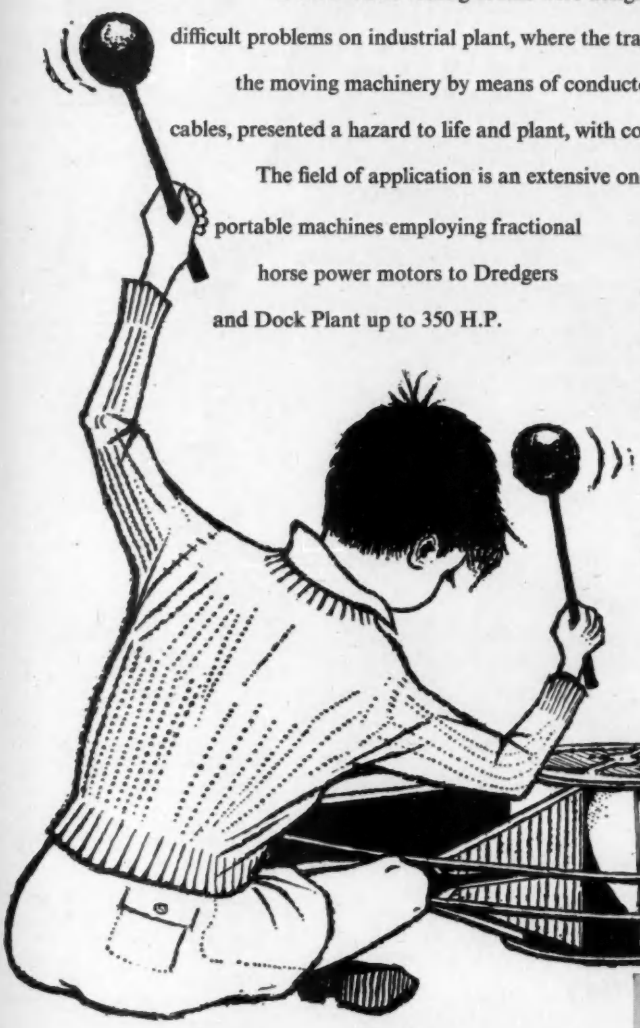
TELCO LTD., 3 Newman Street, London, W.1 MUSeum 5701/4

you can't beat this drum

DECO Cable reeling drums were designed and developed to solve one of the most difficult problems on industrial plant, where the transmission of electrical supply to the moving machinery by means of conductor rails, trolley wires, or loose trailing cables, presented a hazard to life and plant, with consequent loss of production.

The field of application is an extensive one, ranging from small portable machines employing fractional horse power motors to Dredgers and Dock Plant up to 350 H.P.



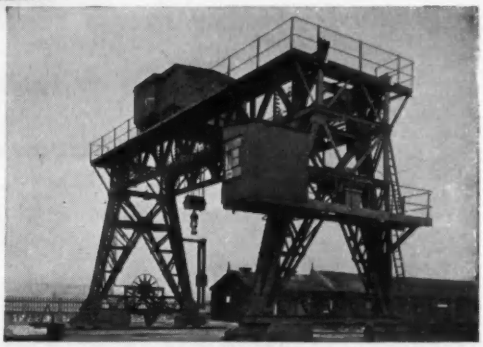
range of DECO equipment includes:

Special Electrical Equipment for every class of Handling Plant. Winch Limiting Mechanisms with special quick reset features, Shunts and Ultimate Series Type, Float Controls.

Contact Collector Columns for all classes of Cranes, Slurries, Turntables, Mixers, etc. Emergency chain and wire operation system trip switches. Centrifugal Switches. Special limit and control switches, push buttons and auxiliary devices for automatic operation of Material Handling Plants.

"DECO" patent Hose Reeling Drums, Patent No. 370,076/32, for use with Fluids, Overhead collector equipment up to 650 volts D.C. 6,600 volt Reeling Drums for special applications.

ASSOCIATED COMPANY: **GRILL FLOORS LTD** manufacturers of: Grill Floors for Platforms and Mezzanine Floors, Steel Lattice Ladders, Patented Hand Railing, Grills for Coal Screens, Access Ladders with Convex Visible Edge Stairtreads, Window Cleaning Galleries, Trench Gratings, Duckboards, Servo Docks, Vehicle Washes, Scaffold Boards.



An illustration of a counter-weight operated radial reeling drum accommodating 130 feet of 4-core 1.3" overall diameter reinforced trailing cable for a 40-ton Goliath crane. (Photograph by kind permission of Messrs. Stothert & Pitt Ltd.)

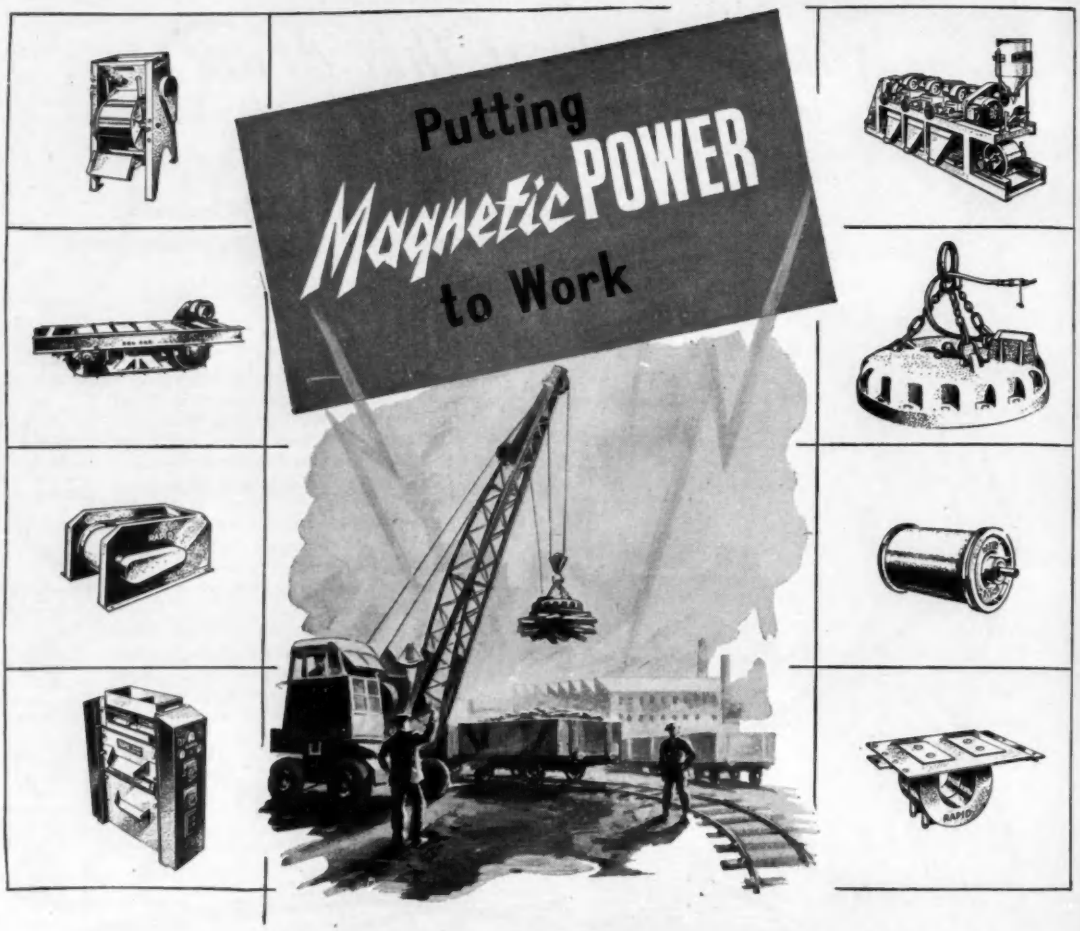
DECO

cable reeling drums

DECO ENGINEERING CO LTD WEST ROW NORTH KENSINGTON LONDON W10

Tel: Ladbroke 3066/7 Grams: Etyladec Wesphone London

P.794



★ **Extracting iron from processed materials**

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World user equipment of high repute

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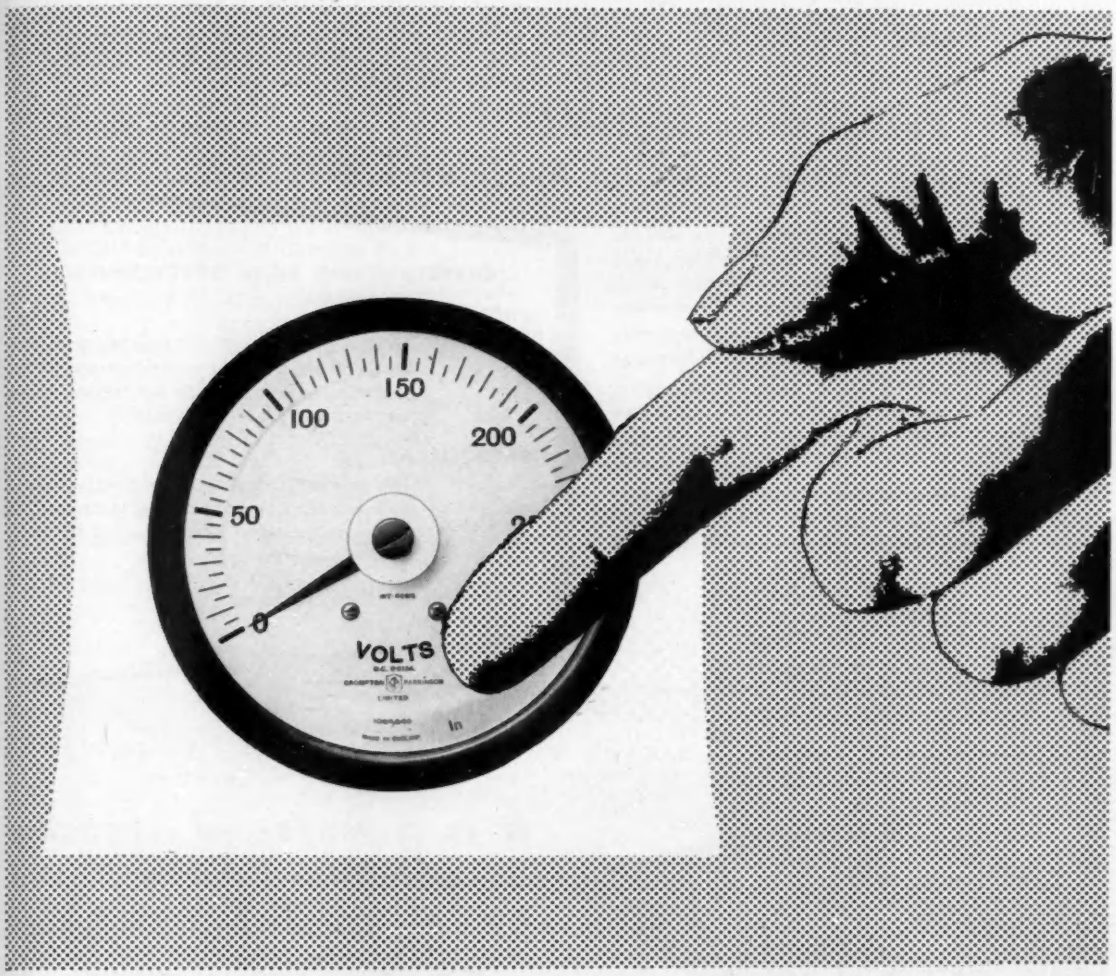

No sufferer from cramp

Crompton Parkinson instruments are indeed extremely accurate—and their robust and carefully thought out design ensures that they maintain this accuracy throughout their lives. But the accuracy of the finest instrument can be impaired by a cramped scale or by parallax errors in reading.

Circular scale instruments open the scale out by considerably increasing its length—10 in. instead of 6 in. in a 6 in. diameter instrument. And the Crompton platform scale in which the pointer is level with the scale markings eliminates parallax even at oblique angles. Finally, remember—Crompton Parkinson make a wide range of *portable* circular scale instruments.

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MEMBER OF ATOMIC POWER CONSTRUCTIONS LTD.

One of the five British nuclear energy groups

MAKERS OF ELECTRIC MOTORS OF ALL KINDS · INSTRUMENTS
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Rubber Components for the more Exacting Applications

Our wide experience in the field of precision rubber engineering qualifies us to advise on the rubber compounds and design of components to meet the more exacting applications.

Our plant is fully equipped to deal with bulk production as well as small quantity requirements for prototype and development work.

Designers and Engineers will be interested in our new publication, 'Synthetic and Natural Rubbers and their Uses' — copy sent upon request.

High Grade Rubber Mouldings and Extrusions · 'O' Rings Seals · Bushes · Grommets · Diaphragms · Bonded Parts and Components in Natural, Synthetic and Silicone Rubbers

OUTSTANDING NEW DEVELOPMENTS

PRESCOLASTIK

Silicone Rubbers in general purpose, low temperature and low compression set grades, available in a range of hardnesses. New fuel resistant grade also available.

PRESCOLLAN

The new polyurethane rubber with remarkable tear and abrasion resisting properties, easily machinable. Ideally suited to heavy duty engineering applications.

Please write for technical leaflets.

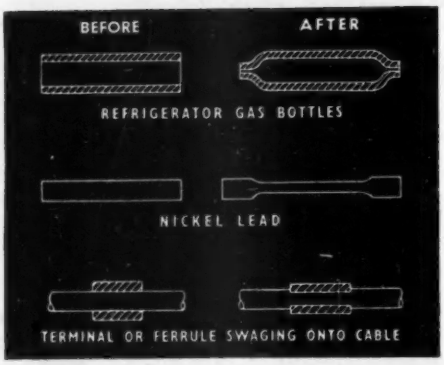
APPROVED A.I.D. AND A.R.B.

PRECISION RUBBERS LIMITED · BAGWORTH · LEICESTER · Phone: BAGWORTH 241/2/3

Producers of Rubber Mouldings to fine dimensional tolerances and officially approved specifications

What is Rotary swaging

It is a means of reducing or pointing tube and rod by a hammering process



Reducing powder filled steel inconnel and copper elements Tungsten and Molybdenum wire for filaments. Necking refrigerator gas bottles.

TIME, MATERIAL AND MONEY IS SAVED

- No wastage of material
- Operated by unskilled labour
- Cheapest and Quickest method

SEND FOR FULL PARTICULARS—***It might solve your problem***

STEVENS & BULLIVANT LTD.
Western Road · BIRMINGHAM 18

Telephone: NORthern 4514/5 and 0236
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Aeroflex

ENERGY LIMITING

CARTRIDGE FUSES TO CLASS P

This new range of Aeroflex Fuses (AD and FC type) Category 440 AC5 Class P - is fully interchangeable with the former patterns and is now supplied in all listed Fluvent Switch and Fusegear. They offer refinements in performance, primarily due to the following factors:-

TECHNICAL DATA

Publication CF2 deals extensively with the subject and affords interesting data. A copy will be forwarded gladly to enquirers and students.

These characteristics are extensively detailed in this new publication, CF2, which reproduces actual oscillograms obtained during ASTA tests.

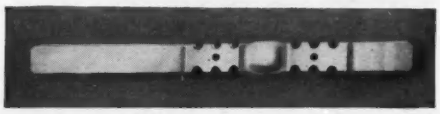
(1) The proved Breaking Capacity is raised from 33 to 46 K.A.

(2) The Energy Limiting is uniformly developed throughout the range.

(3) The fusing Factor is standardised at 1.25 throughout the range.

(4) The cartridge cases are ceramic instead of fibre.

(5) The end caps are fixed instead of being detachable as in the AF pattern, and re-wiring is normally carried out by returning blown cartridge fuse-links to the factory and not on site.



★ *The latest types of Aeroflex fuse element as employed in the AD and FC type Energy Limiting Fuses.*

Rewireability : Fuse Links are not discarded when blown —they can be returned for prompt replacements under our rewiring service scheme.

Parmiter Hope & Sugden Ltd

FLUVENT ELECTRICAL WORKS · LONGSIGHT · MANCHESTER 12

London : 34 Victoria Street, S.W.1. *Glasgow :* 5 Somerset Place, C.3. *Birmingham :* 39/41 Carrs Lane, 4.

dm PH83

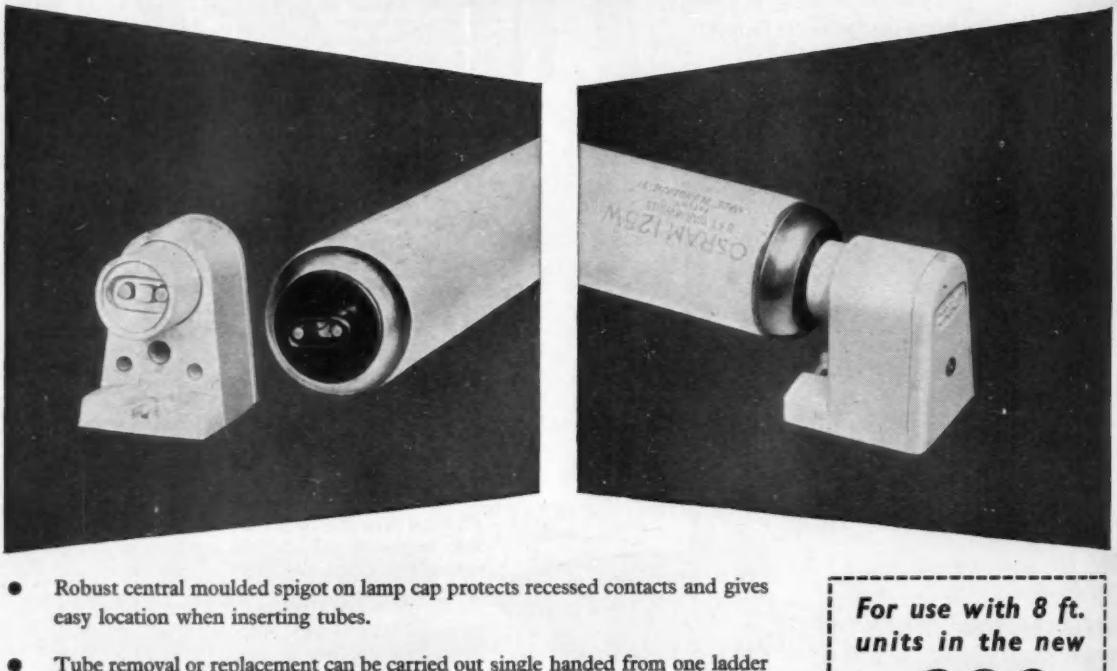
NEW R.D.C.* CAP

FOR

Osram

8ft. 125W. GUARANTEED TUBES

* *Recessed Double Contact*



- Robust central moulded spigot on lamp cap protects recessed contacts and gives easy location when inserting tubes.
- Tube removal or replacement can be carried out single handed from one ladder position at either end of the fitting.
- New cap design gives firm, reliable location and support for the tube without the need for independent clips.
- Electrical connections made by spring-loaded plungers in retractable holders.
- Compact cap and holder unit enables dark area to be reduced at end of fitting.

For use with 8 ft. units in the new

G.E.C.

101 *range*

of

Fluorescent lighting fittings

Osram *FOR PROGRESS AND SUPERB QUALITY*

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

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CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue and should be addressed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

BIHAR STATE ELECTRICITY BOARD

THE Office of the Bihar State Electricity Board invites tenders for the following:—

TENDER NOTICE No. 2/1958.

Sealed tenders for the supply of equipments and materials for the 132-kV substations at Deoghar and Sultanganj and for erection thereof will be received till 12.30 p.m. on the 7th July, 1958, and will be opened in the presence of such of the tenderers who may be present on the same date at 2 p.m. Copies of the specification can be obtained from the Electrical Superintending Engineer (Technical) on payment of Rs. 75/- (Rupees seventy-five) only for each copy of specification (non-refundable) to the Controller of Accounts, Bihar State Electricity Board, Patna, either in cash or in money order. Prices should be quoted F.O.R. Deoghar and F.O.R. Sultanganj, and should include freight, insurance, sales tax and all other charges.

Tenders should be accompanied by an Earnest money deposit of Rs. 10,000/- (Rupees ten thousand) only either as bank draft or deposit at call on the State Bank of India, Patna, in the name of the Board.

The Chief Engineer reserves the right to reject any or all tenders without assigning any reason. 3873

BOROUGH OF FOLKESTONE

Street Lighting, Trunk Road A.20: Cheriton Road, Cheriton High Street

TENDERS are invited for the provision of 32 Street Lighting Units consisting of columns, lanterns, lamps, auxiliary and control gear.

Specification and form of tender may be obtained on application to Mr. E. L. Allman, Municipal Offices, West Terrace, Folkestone, and deposit of two guineas with the Borough Treasurer at the same address. This sum will be refunded on receipt of a bona fide tender and return of all documents.

Tenders must be returned, in the plain sealed envelopes provided, to the undersigned not later than the 4th July, 1958.

General conditions of contract may be seen at the office of the Borough Engineer, to whom all enquiries must be addressed.

N. C. SCRAGG,
Town Clerk.

Municipal Offices,
West Terrace, Folkestone.
9th June, 1958. 3855

DAMODAR VALLEY CORPORATION

THE Office of the Damodar Valley Corporation, Anderson House, Alipore, Calcutta, 27, India, invites tenders for the following:—

D.V.C. Tender Enquiry No. PE.SPEC. 51, for the supply of Control Panels and Panels for on-load Tap Changers for the Grid Substations.

Specifications, drawings, etc., relative to the above can be obtained direct from the Damodar Valley Corporation, of the above address, at 15 shillings per copy plus £1 17s. 6d. for air parcel charges. Tenders are to be returned direct to the Damodar Valley Corporation, Anderson House, Alipore, Calcutta, 27, India, so as to reach them by 3 p.m. on 17th July, 1958.

Specimen copy of the above specification is on view at India Store Department, Government Buildings, Bromyard Avenue, Acton, London, W.3, under reference S3260/58/AVH/ENG2. 3844

COUNTY BOROUGH OF READING

To Electrical Contractors

FIRM price tenders are invited for the alteration and re-wiring of the existing system at Wilson Secondary School.

General conditions may be inspected and the specification, drawing and form of tender can be obtained from the Borough Architect, Town Hall, Reading.

Tenders to reach the Town Clerk, Town Hall, Reading, by noon, Tuesday, 8th July, 1958. No tender considered unless enclosed in the endorsed envelope provided, which shall bear no indication of the sender.

The Corporation do not bind themselves to accept the lowest or any tender. 3837

CITY OF MANCHESTER HOUSING COMMITTEE

TENDERS are invited (returnable noon 7th July, 1958) for ELECTRICAL INSTALLATIONS on the following contract:—

Contract No. 250/250a, Hazel Grove and Bramhall, 331 dwellings.

Particulars and documents obtainable from the Director of Housing, Town Hall, Manchester, 2. 3890

DURHAM COUNTY COUNCIL

TENDERS invited: Ryton New County Infants' School—Electrical Installation.

Application for further details to County Architect, South Street, Durham, not later than 2nd July, 1958.

J. K. HOPE,
Clerk of the County Council.

Shire Hall,
Durham. 3889

SITUATIONS VACANT

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

(1) **Third Assistant District Engineer, Rutherglen District.**
(2) **Third Assistant District Engineer, Coatbridge District.**
(3) **Third Assistant District Engineer, Newland District.**

APPLICATIONS are invited for the above appointments. Applicants should possess the necessary technical qualifications and should have had a sound engineering training with subsequent experience in the operation and maintenance of H.V. and L.V. distribution systems. They should be conversant with load flow diagrams and voltage drop calculations.

The salary and conditions of service will be in accordance with the National Joint Board Agreement, Schedule A; the present classification and grading for each appointment is F.9, present salary £790/£835 per annum. These posts are superannuable, subject to satisfactory evidence of health. The successful candidates will require to reside within a reasonable distance of their respective district offices and to take standby duty in accordance with the above agreement.

Application forms, which may be obtained from the undersigned, should be forwarded to this office within 14 days of the date of this advertisement.

R. J. RENNIE,
Manager.

Montrose Crescent,
Hamilton. 3896

DIPLOMATIC WIRELESS SERVICE (Foreign Office)

APPLICATIONS are invited from qualified candidates to fill, by competitive interview, the following posts.

SUPERVISING ENGINEER to undertake technical co-ordination and supervision of a group concerned with branches of Radio, Electronic and Audio Frequency Engineering. Post gives considerable scope for originality. Qualifications required: Science or Engineering Degree or A.M.I.E.E., or equivalent

Salary £1,180 - £1,325.

SENIOR AND JUNIOR ENGINEERING INSPECTORS required for specialised work relating to Telephone, Electronic, Radio and Audio Frequency Engineering at home and abroad. Extensive overseas travelling, short duration tours. Qualifications required: Senior posts, Science or Engineering Degree or City and Guilds Final Certificate, or equivalent. Junior posts, at least Intermediate level.

Salary: Seniors £974-£1,180; Juniors £820 (at age 30) to £974. Plus £50 p.a. special allowance and appropriate subsistence rates when travelling.

SENIOR INSTALLATION AND PLANNING ENGINEER. Candidates should have a wide knowledge of automatic and manual telephone installations up to a capacity of 1,000 lines and be conversant with modern planning and costing procedure. Qualifications required: City and Guilds Final Certificate or equivalent.

Salary £820 (at age 30) to £974.

OVERSEAS MAINTENANCE ENGINEERS (Senior and Junior) required to install and maintain telephone installations and other communication apparatus in premises overseas. Applicants should be experienced in one or both of the following:—

(a) Installation and maintenance of PAX, PABX, PMBX and other subscribers' apparatus.
(b) Maintenance of machine telegraph equipment.

Qualifications required: City and Guilds Final Certificate (Telecommunications). For applicants of exceptional practical ability Intermediate level acceptable.

Salary: Seniors £655 (at age 26) to £820; Juniors £506 (at age 25) to £705.

Write, giving age, qualifications and experience, to:—

Chief Establishment Officer
DIPLOMATIC WIRELESS SERVICE
Foreign Office, London, S.W.1
3857

INSPECTOR OF WORKS (ELECTRICAL)

required by LAGOS TOWN COUNCIL, NIGERIA, Town Engineer's Department on contract for 2 tours of 12/24 months in first instance.

Salary according to qualifications and experience in scale (including inducement addition) £864 rising to £1,308 a year. Gratuity at rate £100/£150 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards cost of children's passages and grant up to £150 annually towards maintenance in U.K. Liberal leave on full salary.

Candidates must have had a good general education and have served a recognised apprenticeship to one of the electrical engineering trades.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/49967/EF. 3902

Situations Vacant (continued)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division:—

GENERAL ASSISTANT ENGINEER, DRAKELOW POWER STATION (Vacancy No. 91/58/ER).

Applicants should be suitably qualified young men who are interested in power station operation and/or maintenance as a career.

Facilities are available whereby experience can be obtained in all sections of a large modern power station, and the prospects of advancement are real to those who are willing to take advantage of the opportunities.

The salary during the initial training period will depend upon qualifications and knowledge and will be within the range £540-£680 per annum of the National Joint Board Agreement.

Closing date for receipt of applications, 25th June, 1958.

STATION SHIFT CONTROL ENGINEER, STAYTHORPE POWER STATION (Vacancy No. 93/58/ER).

Applicants should have had a sound training and practical experience in a modern power station. The possession of a Higher National Certificate or its equivalent would be advantageous.

The salary will be in accordance with Class K, Grade 10 (£935-£995 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 25th June, 1958.

GENERAL ASSISTANT ENGINEERS, WILLINGTON, STAYTHORPE AND OTHER LARGE POWER STATIONS (Vacancy No. 92/58/ER).

Applications are invited from suitably qualified young men who are interested in power station operation and/or maintenance as a career.

Facilities are available whereby experience can be obtained in all sections of a large modern power station, and the prospects of advancement are real to those who are willing to take advantage of the opportunities.

The salary during the initial training period will depend upon qualifications and knowledge and will be within the range £540-£730 per annum of the National Joint Board Agreement.

Closing date for receipt of applications, 25th June, 1958.

FOURTH ASSISTANT ENGINEER, STAYTHORPE TRANSMISSION SECTION (Vacancy No. 95/58/ER).

Applicants should have experience of the maintenance and operation of E.H.T. overhead lines, transformer and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 8 (£710-£935 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 2nd July, 1958.

FOURTH ASSISTANT ENGINEER, DRAKELOW TRANSMISSION SECTION (Vacancy No. 96/58/ER).

Applicants should have experience of the maintenance and operation of E.H.T. overhead lines, transformer and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 8 (£710-£935 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 2nd July, 1958.

THIRD ASSISTANT ENGINEER (Electrical), GENERATION (Construction) DEPT., CASTLE DONINGTON POWER STATION SITE (Vacancy No. 94/58/ER).

Applicants should have had a fundamental training in electrical engineering, including workshops and should preferably have had experience in the manufacture, erection and maintenance and operation of electrical plant as installed in modern power stations. Preference will be given to candidates who possess a degree or are Graduate Members of the Institution of Electrical Engineers.

Salary will be within Class AX/EX, Grade 6 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 2nd July, 1958.

ENGINEERING DRAUGHTSMAN (Civil), CONSTRUCTION DEPARTMENT, NORTH WILFORD POWER STATION (Vacancy No. 97/58/ER).

Applicants should have experience in design and detail of reinforced concrete structure, piled and slab foundations for heavy plant, culverts, cable subways, etc., for general building construction drainage and sanitation schemes, associated with official and administrative buildings.

The salary will be in accordance with Grade 6 (£595-£715 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 2nd July, 1958.

STATION SHIFT CONTROL ENGINEER, CASTLE DONINGTON POWER STATION (Vacancy No. 98/58/ER).

Applicants should have had a sound training and practical experience in a modern power station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be an advantage.

Salary will be in accordance with Class L, Grade 10 (£995-£1,055 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 2nd July, 1958.

These appointments will be pensionable under the terms of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. PLEASE QUOTE VACANCY NUMBER.

L. F. JEFFREY,
Divisional Controller.

12th June, 1958. 3877

JOSEPH LUCAS
(ELECTRICAL) LIMITED

Great King Street, Birmingham, 19

ENGINEER

EXPANSION of development of ignition equipment for gas turbines and allied projects creates a vacancy for a practical engineer with experience of design for economic production of electrical apparatus. The work is of a high technical standard and applicants should preferably possess an honours degree.

The post is permanent and pensionable and offers considerable scope for advancement to a progressive engineer.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Birmingham, 19, quoting reference PM/D/190.

128

NORTH EASTERN ELECTRICITY BOARD

York Sub-Area

APPLICATIONS are invited for the appointment of SECOND ASSISTANT ENGINEER (Planning and Development, Sub-Area Headquarters, York. Duties of the post will include preparation of schemes for extensions and reinforcement to overhead and underground H.V. and L.V. networks. Applicants should have had sound experience in electricity supply distribution. Possession of suitable technical qualifications an advantage.

Salary Schedule A, Class H, Grade 7, £995/£1,055. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by the Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O., Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 3900

SOUTH OF SCOTLAND ELECTRICITY BOARD

Nuclear Generating Station

APPLICATIONS are invited for the following superannuable appointments at the Board's Nuclear Generating Station which is being constructed at Hunterston, near Largs, Ayrshire :—

1. REACTOR PHYSICIST (Reference No. E15/58).

Candidates must have a degree in physics or engineering and must have had some years of industrial experience in a responsible position.

The successful candidate will be responsible for nuclear physics measurements on the reactors and for maintaining technical efficiency of reactor operation. Adequate training will be given in the operation of nuclear reactors.

Salary range £1,560 × £35 to £1,665 per annum.

2. HEALTH PHYSICIST AND SAFETY OFFICER (Reference No. E16/58).

Candidates must have good scientific qualifications, preferably of degree standard in either engineering or physics. Some experience in the control of labour will be an advantage.

The successful candidate will be responsible for radiation measurements and for the control of radiological hazards in and around the station. A course of specialised training will be given in health physicist work.

Salary range £1,560 × £35 to £1,665 per annum.

3. INSTRUMENT ENGINEER (Reference No. E17/58).

The minimum technical standard will be the possession of a Higher National Certificate. Previous experience of power station instrumentation and control equipment is desirable.

The successful candidate will be responsible for instrumentation and control equipment on both conventional and nuclear plant in the station. A course of specialised training will be given in nuclear instrumentation and control equipment.

Salary range £1,325 × £30 to £1,415 per annum.

Apply, quoting appropriate reference number, on standard form AE.6, available from the Secretary, P.O. Box 173, 351, Sauchiehall Street, Glasgow, C.2, not later than Friday, 18th July, 1958. 3860

THE ELECTRICAL RESEARCH ASSOCIATION

requires a leader for an existing team engaged in constructing a large automatic testing station for resistors and other electronic components at its Leatherhead laboratories.

Applicants must be able to control a team of about 10 junior workers, and to design and supervise the construction of simple electronic and control circuits, with the associated mechanical gear. Initiative and organisational ability will be of more value than academic qualifications.

Salary will depend on age and experience, but a figure up to £1,200 is offered for a suitable candidate.

Other vacancies exist for:—

(1) Research into the mechanisms of failure in novel types of resistor.
(2) The collection, assessment and analysis of data on electronic component failures.
(3) Research on the effects of low temperature storage of electronic components.

For some of these vacancies recent graduates or applicants with H.N.C. would be considered.

Applications should be sent as early as possible to the Secretary, The Electrical Research Association Laboratory, Cleeve Road, Leatherhead, Surrey. 3845

YORKSHIRE ELECTRICITY BOARD

No. 7 (Grimsby) Sub-Area

SCUNTHORPE DISTRICT

INSTALLATION INSPECTOR. N.J.I.C. conditions and rate of pay, the present rate being 5s. per hour for a 44-hour, 5-day week.

Applications, quoting ref. 7/S.A.R. and giving details of age, experience, etc., together with the names of two referees, to be sent to the District Manager, Yorkshire Electricity Board, 37, High Street, Scunthorpe, to arrive not later than the 4th July, 1958. 3901

SOUTH EASTERN ELECTRICITY BOARD

GENERAL ASSISTANT ENGINEER,
Tunbridge Wells District.

Salary £740-£785 p.a. under N.J.B. Class F, Grade 10. Candidates should possess the H.N.C. in Electrical Engineering or its equivalent.

Applications to Tunbridge Wells District Manager, SEEBOARD, Town Hall, Tunbridge Wells, Kent, by 7th July, 1958.

ASSISTANT ENGINEER,
Herne Bay/Canterbury District.

Salary £635 × £15 to £680 under N.J.B. Class E, Grade 11. Superannuable. Candidates should preferably have the Higher National Certificate or equivalent and practical experience in the operation, maintenance and construction of M.V. and 11-kV underground and overhead systems.

The appointment will involve standby duty.

Applications, naming two referees, to Herne Bay/Canterbury Joint District Managers, SEEBOARD, 65, Mortimer Street, Herne Bay, Kent, by 2nd July, 1958.

SENIOR COMMERCIAL ASSISTANT,
Brighton and Hove District.

Salary £690 × £20 to £750 per annum, under N.J.C. Grade 3. Superannuable. Applicants of good general education should be fully experienced and able to advise on all supply matters including the application of the Board's tariffs, sales of domestic appliances and the preparation of quotations for domestic, commercial and industrial electrical installations. A knowledge of the basic principles of space heating an advantage.

Applications, naming two referees, to Brighton and Hove District Manager, SEEBOARD, Electric House, Castle Square, Brighton, by 2nd July, 1958.

GEORGE WRAY,
Secretary.
3895

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London allowance. Qualifications entitling to Graduate Membership of I.E.E. or I.Mech.E. an advantage.

ASSISTANT MAINTENANCE ENGINEER (Mechanical),
BARKING A/B POWER STATION
(Vacancy No. 58/421).

Candidates must have had considerable experience with mechanical maintenance and overhaul of large turbo-alternators, boilers (p.f. and chain grate), auxiliary plant and control of machine shop, also wide experience in control of all grades of personnel. Successful applicant will be responsible (under Maintenance Engineer—Mechanical) for efficient planning and completion of plant overhaul. Salary Class L, Grade 8 = £1,210 p.a.

ASSISTANT ENGINEER
(Repair and Maintenance),
FULHAM POWER STATION
(Vacancy No. 58/422).

Applicants should have had sound technical training and have had experience of power station operation or maintenance. Salary Class K, Grade 15 = £725 p.a.

Applications, quoting vacancy number, to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 30th June, 1958. 3863

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

THIRD ASSISTANT ENGINEERS (Control) are required in the System Operation Department. N.J.B. service conditions, superannuable appointments, salary within Schedule B, Grade 6, £895-£1,140 per annum, plus 10% shift allowance.

Applicants should possess Higher National Certificate in Electrical Engineering and have considerable experience of power station and grid system operation.

Apply, quoting vacancy number 818MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 3rd July, 1958. 3894

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Northmet Sub-Area

THIRD ASSISTANT ENGINEERS
(a) HENDON DISTRICT
(Ref. 793). 68/58.R.
(b) STEVENAGE DISTRICT
(Ref. 706). 66/58.R.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary :—
(a) N.J.B. Class G, Grade 9 (£835-£880) plus London allowance.
(b) N.J.B. Class F, Grade 9 (£790-£835).

For these appointments apply by letter, by 30th June, 1958, as follows :—
(a) R. F. Winder, M.I.E.E., Manager, Eastern Electricity Board, 137/139, Brent St., Hendon, London, N.W.4.
(b) H. L. Sumner, Manager, Eastern Electricity Board, Walkern Rd., Stevenage, Herts.

Chilterns Sub-Area

WATFORD DISTRICT. 67/58.R.
SENIOR DEMONSTRATOR.

Candidates should hold the E.A.W. Certificate and Diploma. Experience in the organisation of public demonstrations and lecturing on domestic electrical subjects, together with proved sales ability, preferably with direct experience in the sale of all types of domestic apparatus, is essential.

Salary N.J.C. Grade 2 (£615-£675) plus London allowance.

Apply by letter, within 14 days, to the Manager, Watford District, Eastern Electricity Board, The Parade, High Street, Watford. 3892

A.E.I. - JOHN THOMPSON NUCLEAR ENERGY CO. LTD.

Radbroke Hall, Knutsford, Cheshire

AN ENGINEER

is required for work in the

COMMISSIONING DEPARTMENT

Candidates should have considerable knowledge of the problems involved in operating large power stations. Experience in power plant testing would be an advantage. Training in the nuclear aspects of the work will be arranged, and the successful applicant will be expected to assist in all aspects of the commissioning of nuclear power plant both in this country and abroad.

The offices are situated at Knutsford. The position is a permanent staff appointment and a contributory pension scheme is in operation.

Apply in writing, giving details of age, experience, qualifications and present salary (which will be treated in strict confidence) to the Chief Engineer, quoting reference C.O.M./STF.

3882

SALES REPRESENTATIVE

required for East London, S.E. England, Norfolk and Cambridge to promote sales of ASHLEY Guaranteed Electrical Installation Accessories. Would suit energetic enthusiast having electrical experience and connections with the electrical trade, etc., in this area.

Salary, commission, expenses, pension scheme. Car provided.

Full letter giving qualifications, career, age, home telephone, etc., confidentially to Sales Director, Ashley Accessories Ltd., Ulverston, N. Lancs. All applications acknowledged. 3866

NORTH WEST METROPOLITAN REGIONAL HOSPITAL BOARD

APPLICATIONS invited for the following posts:—

ASSISTANT ENGINEERS,
ELECTRICAL, MECHANICAL,
HEATING AND VENTILATING.

Applicants must be at least (a) Graduate Members of the Institution of Electrical Engineers and have passed the Institution examination or recognised exempting examinations; or (b) Graduate Members of the Institution of Mechanical Engineers and have passed Sections A and B of the Associate Membership examination, or recognised exempting examinations; or (c) Graduate Members of the Institution of Heating and Ventilating Engineers, and have passed the Associate Membership examination, or recognised exempting examinations.

Salary scale £700 × £25 (3) × £30 (1) × £35 (6) to £1,015, plus £20-£50 London weighting.

ENGINEERING ASSISTANTS (Grade II).

Applicants must have O.N.C. or other approved qualification in appropriate engineering subjects.

Salary scale £525 × £20 (4) × £25 (5) to £730, plus £20-£30 London weighting.

Starting salaries in both grades may be above minimum having regard to relevant practical experience. Whitley Council conditions. Superannuable.

Apply, stating which post, and give age, qualifications (with dates) and experience, together with names and addresses of two referees to Secretary, North West Metropolitan Regional Hospital Board, 11a, Portland Place, London, W.1, by 30th June. 3840

ENGLISH ELECTRIC

AIRCRAFT EQUIPMENT DIVISION

"Measurements Engineer"

THERE is a vacancy for an ENGINEER or PHYSICIST to join a team concerned with developing measurement techniques in the following fields:—

Aircraft flow measurement, particularly quantity and velocity.

Torques.

Highly accurate linear measurements.

Time, particularly related to time constants of electrical circuits.

Other electrical quantities.

Applicants should have experience in one or more of these subjects. The appointment offers scope for further research.

Reply giving full details to Dept. C.P.S., 336/7, Strand, London, W.C.2, quoting reference ER 212D.

3846

ENGINEERS FOR THE DEVELOPMENT OF RAILWAY SIGNALLING APPARATUS

SEVERAL ENGINEERS are required for work on signals, track apparatus, relays, relay racks, control panels, remote control systems, automatic train control, automatic control of marshalling yards, etc. Previous experience of this type of work is not essential, but for some of the positions a knowledge of electronics will be an advantage.

The minimum technical qualification required is the Higher National Certificate (or equivalent).

These positions are pensionable and based on Trafford Park.

Write for application form, quoting reference K.11, to :—

Personnel Manager
METROPOLITAN-VICKERS ELECTRICAL CO. LTD.
Trafford Park, Manchester, 17

3880

Situations Vacant (continued)

COLLEGE OF TECHNOLOGY, BIRMINGHAM

Principal: P. F. R. Venables, Ph.D., B.Sc., F.R.I.C.

HEADSHIP OF THE DEPARTMENT OF ELECTRICAL ENGINEERING

APPLICATIONS are invited from highly qualified experienced persons for the headship of this large and important department, which is in a period of rapid development, both at undergraduate and postgraduate level, including postgraduate courses and research. The department also has 263 students attending sandwich courses leading to the Diploma in Technology, and 40 of these will be the first in the country to sit these examinations this year. Relevant industrial, research and/or development experience is essential; full-time/part-time teaching experience desirable.

Salary scale £2,300 × £50 to £2,500; special attention is drawn to the fact that in fixing the starting salary additional increments may be added up to the maximum in respect of industrial, commercial or professional experience, or research work as approved by the Governors.

Duties to commence as soon as possible, preferably in time for the start of the next session in September, 1958.

Further particulars and forms of application may be obtained from the Registrar, College of Technology, Gosta Green, Birmingham, 4, on receipt of stamped addressed foolscap envelope. Closing date within 18 days after the appearance of this advertisement.

K. R. PILLING,
Clerk to the Governing Body.
3893

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Maintenance and Operation)

Newbury District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class F, Grade 11 (£685-£730 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance and operation of substations and H.V. and L.V. distribution mains and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Rd., Newbury, Berks, and returned to him, quoting Z.916, in envelopes suitably endorsed, not later than 30th June, 1958.

General Assistant Engineer

Sub-Area Engineering Department (Meter Section) of No. 1 (Southall) Sub-Area, located at Waterloo Road, Uxbridge, Middlesex. Salary N.J.B. Class L, Grade 16 (£725 - £770 per annum, inclusive of London allowance). N.J.B. conditions of service.

Applicants should have experience in three-phase meter testing, instrument transformer testing, assisting in the standardising of watt-meters and the commissioning of special equipment.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.902, in envelopes suitably endorsed, not later than 30th June, 1958.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. 3899

MIDLANDS ELECTRICITY BOARD

SENIOR ASSISTANT required in the Gloucester District of the Central Gloucestershire Sub-Area.

The successful applicant will be first assistant to the District Senior Clerk in the general organisation and supervision of the District clerical work, including pricing and billing of contracting work, credit sale agreements, etc., wages and stores, and particularly in the control of consumers' records.

Salary £765/£840 per annum (N.J.C. Grade 4). Superannuable.

Apply by letter, within seven days, stating age, experience, qualifications, present position and salary to Mr. S. Raybould, Sub-Area Manager, Midlands Electricity Board, 126, London Road, Gloucester.

A. STEPHENS,
Secretary. 3891

PAKISTAN ORDNANCE FACTORIES

THE ISLAMIC REPUBLIC OF PAKISTAN invites applications for the following posts in the Pakistan Ordnance Factories:—

ASSISTANT WORKS MANAGERS (2).

Employed, under works manager (electrical), in connection with erection and installation of industrial electrical equipment of the ordnance factories and to assist in supervision of work of electrical contractors. Candidates MUST have had considerable experience in the requirements of and installations in factories handling sensitive explosives and be acquainted with safety regulations.

A recognised professional qualification equivalent to Associate Membership of an appropriate professional institution desirable but not essential.

PERIOD OF CONTRACT: Two years in first instance.

RATES OF PAY (Rupee = 1s. 6d.): Within the scale of Rupees 950-50-1,350 per month (starting pay according to qualifications and experience, plus overseas pay at £25 sterling per month, plus a technical staff allowance of Rupees 300 per month.

Pay and overseas pay from date of embarkation.

Technical staff allowance payable from date of arrival in Pakistan.

Contributory provident fund scheme in operation.

Forms of application may be obtained upon application IN WRITING, to the Co-ordination Officer, P.O.F. (T. & R.), Office of the High Commissioner for Pakistan in U.K., 39-40, Lowndes Square, London, S.W.1, quoting Dept. E.R. Closing date for applications, 4th July, 1958. 3897

ELECTRICAL ENGINEERS

Public Works Department, Federation of Nigeria

THE design, supervision and maintenance of electrical installations in Government buildings, hospitals, staff quarters, etc. The investigation and application of modern forms of electrical wiring to tropical conditions is a particular duty of the appointment. These duties will be carried out under the supervision of the Senior Electrical Engineer.

Contract appointment in the salary range £1,412 to £2,163 a year plus a gratuity of £37 10s. for each 3 months' satisfactory service. Quarters if available at low rental. Free passage for officer and wife, and children up to cost of two adult fares. Allowance of £75 for each of two children maintained in U.K. Free medical and dental treatment.

Candidates, between 28 and 45, must be A.M.I.E.E. or be exempt from the Institution's examination. They should have had experience in all classes of installations from estimates to completion of large buildings and of oil engine standby generating plant. A knowledge of tariffs and power factor correction would be an advantage.

Write, stating age, qualifications and experience, to Director of Recruitment, Colonial Office, London, S.W.1. Quote BCD 112/14/014. 3859

JOSEPH LUCAS (ELECTRICAL) LIMITED

ASSISTANT ELECTRICAL DESIGN ENGINEER

required for the design of rotating electrical machines and electro-magnetic devices. Projects will include fundamental design investigations, and full scope will be given for initiative and imagination.

The post is permanent and pensionable.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Limited, Great King Street, Birmingham, 19, quoting reference PM/D/221.

COMPUTER ENGINEER

BOOTS PURE DRUG Company Limited wish to appoint a graduate engineer, preferably under 35 years of age, with an honours degree in light current engineering or allied subjects and experience in electronic data processing or some related field.

The Company is embarking on the installation of an extensive commercial electronic data processing system. Equipment on order includes a large scale general purpose digital computer, a special purpose electronic sterling accumulator, and a wide range of peripheral equipment including a character recognition device. The system is due for installation during 1959. Development of the data processing centre is expected to continue for some years.

The successful candidate will be responsible for liaison with the manufacturers before and during the installation period. He will be required to set up a small specialist team for the testing and maintenance of the equipment now under development and construction at the makers' works and for the co-ordination of these projects from the engineering and maintenance viewpoint. Training, as necessary, will be arranged for the selected candidate. The post is a senior one and the computer engineer will be responsible directly to the chief engineer. A generous salary will be paid commensurate with qualifications, age and experience.

Applications should be submitted by the 30th June to the Personnel Manager, Boots Pure Drug Co. Ltd., Station Street, Nottingham. 3805

ASSISTANT ELECTRICAL ENGINEER

required at the

EBBW VALE SECTION

of

RICHARD THOMAS & BALDWINS LIMITED

Candidates should be between 25 and 35 years of age, and should hold the Higher National Certificate in Electrical Engineering. An interest in the application of modern maintenance methods to a wide variety of electrical equipment in a large integrated iron and steel works is desirable.

Salary commensurate with qualifications; Superannuation scheme. The company will assist with housing.

Applications will be treated as strictly confidential, and should be addressed to the—

Chief Engineer

RICHARD THOMAS & BALDWINS LIMITED

Ebbw Vale, Mon.

3788

COLVILLES LTD.

invite applications for the position of

SHIFT CHARGE ENGINEER

for the power station of their new Ravenscraig Works at Motherwell. The station has an initial capacity of 30 MW of electrical plant and 25,000 h.p. of other turbine plant.

The power station is also the control centre for all power services—electricity, gas, water and steam—within a large integrated iron and steel works, and this position offers a wide field of interest.

All applicants should have suitable qualifications and experience in boiler, turbine and switchgear operation.

Possession of a Higher National Certificate will be an advantage.

The position is superannuable.

Applications should be made to the Works Manager, Colvilles Limited, Ravenscraig Works, Motherwell. 3865

MIDDLESEX COUNTY COUNCIL

Education Committee

ENFIELD TECHNICAL COLLEGE
Queensway, Enfield, Middlesex

REQUIRED for 1st September, 1958:—
LECTURERS in ELECTRICAL ENGINEERING (2 posts) to teach Electrical Engineering subjects to Higher National Diploma and Institution of Electrical Engineers Part III standard. The ability to offer electronics and/or electrical measurements will be an added recommendation. Candidates should be University Graduates in Engineering with teaching and/or industrial experience. Corporate Membership of the Institution of Electrical Engineers is desirable.

Salary in accordance with the Burnham (Technical) Report, 1956, i.e. £1,200 × £30 to £1,350, plus London allowance.

Application forms (stamped addressed foolscap envelope) from the Principal to whom completed forms should be returned within 14 days of the appearance of this advertisement.

C. E. GURR, M.Sc., Ph.D.,
Secretary to the Education Committee.

3898

ELECTRICAL DESIGNER

THE world's leading inventors and manufacturers of special-purpose precision machinery for the tobacco industry have opening in their London drawing office for :—

ELECTRICAL DESIGNER.

Desirable applicant should be aged 25-40, with technical qualifications at least up to H.N.C. level and with a broad background of experience in the design of electrical and electro-mechanical equipment as applied to precision machinery.

This opportunity is permanent and progressive ; it offers immediate pensionable monthly staff position with 3 weeks' annual holiday and other advantages.

Applications stating age, qualifications and experience should be personally addressed in confidence to G. B. Salmon.

MOLINS MACHINE CO. LTD.
Evelyn Street, London, S.E.8

3878

ELECTRICAL ENGINEER

A VACANCY has arisen in the London West End head offices of a very large sub-contracting organisation for an

ELECTRICAL ENGINEER

with extensive experience of design, estimating and supervision of all types of contracts. This is a senior position and applications are only invited from engineers engaged on similar work with large sub-contractors. Outside staff will not be considered. The successful candidate will be required to be responsible for contracts from the initial enquiry stages through to completion.

Salary up to £1,500 p.a.

Please write giving full details of age and experience to—Box 3914.

ELECTRIC MOTOR SALES ENGINEER

MOTOR manufacturers who specialise in quality products in the medium H.P. range, A.C. and D.C., seek a SALES ENGINEER who has a good connection and selling record. They offer salary, expenses and generous commission, together with unusual prospects for advancement. Pension scheme in operation and pension rights safeguarded. Replies will be treated in the strictest confidence.

Please reply to Box 3838.

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Division

Appointment of Assistant Engineer (Instruments) Steam Testing Dept., North Tees "A," "B" and "C" Power Stations

APPLICATIONS are invited for the appointment of ASSISTANT ENGINEER (Instruments) in the Steam Testing Department with Headquarters at North Tees Power Station.

The successful applicant will be required to assist in the maintenance of all types of instruments and automatic control equipment associated with boilers and turbines in a modern power station.

Applicants should preferably possess a Higher National Certificate or equivalent qualifications.

The salary for the appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Schedule A, Grade 12, Class K (£835-£880 per annum).

Forms of application may be obtained from Divisional Establishments Officer, Central Electricity Generating Board, North Eastern Division, Carliol House, Newcastle upon Tyne, 1, to whom they should be returned to arrive not later than 7th July, 1958. 3876

CENTRAL ELECTRICITY GENERATING BOARD

Assistant Engineer, System Operation Branch

ASSISTANT ENGINEER required in the System Operation Branch of the Commercial and Operations Department at London Headquarters, to undertake mathematical and statistical investigations requiring the application of statistics and of probability methods to short-term load estimation, including the study of the effect of weather on system load, and to other problems arising in the operation of a large interconnected system. Access to the facilities of a large electronic digital computer will be available.

Candidates should have a knowledge of statistics and should hold a university degree in mathematics or statistics. Experience in meteorological research and a working knowledge of meteorological codes and procedures would be an advantage.

Salary within scale £1,210-£1,570 p.a.

Applications stating age, qualifications, experience, present position and salary to S. S. Scott, Chief Personnel Officer, 24-30, Holborn, London, E.C.1, by 8th July. Envelopes to be marked "Confidential," quoting ref. ER/162. 3875

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

PRINCIPAL ASSISTANT (Sales) required in the Sub-Area Commercial Officer's Department, No. 4 Sub-Area Headquarters, Electricity House, Rhostyllen, near Wrexham. Salary within range £1,145/£1,265 per annum (N.J.C. Grade 8).

The duties include supervision of sales of appliances in service centres, advice on sales promotions, introduction of new appliances, preparation of special displays, co-operation with manufacturers in organising sales campaigns, and organisation and layout of exhibitions and agricultural shows.

Applicants should preferably have had commercial experience in the electricity supply industry, and be able to drive a motor car.

Application forms obtainable from the Manager, at the above address. Closing date 7th July, 1958.

This is a re-issue of a previous advertisement, and applications then made remain under consideration. 3862

SITE SUPERVISORS WANTED

SENIOR DRAUGHTSMEN (2) urgently required for site supervision of services to large and important building project in Central London.

MECHANICAL ENGINEER must have wide experience in heating and ventilating and air conditioning plant installation.

ELECTRICAL ENGINEER must have wide experience in modern lighting and power installation.

Salary commensurate with experience and qualifications. Replies in confidence.—Box 3883

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

APPLICATIONS are invited for the following superannuable appointments :—

(1) AREA MANAGER,
North Caledonia Area centred at Elgin.

Candidates should be fully qualified engineers with practical experience in administration, operation and maintenance connected with generation, transmission and distribution of electricity in an electricity supply undertaking.

(2) DISTRIBUTION ENGINEER,
South Caledonia Area, centred at Perth.

Candidates should be fully qualified engineers with practical experience in administration, operation and maintenance connected with the distribution and transmission of electricity in an electricity supply undertaking.

Terms and conditions of employment for the above posts will be in accordance with the N.J.M. Agreement.

Particulars and application forms may be obtained from the Secretary, 16, Rothesay Terrace, Edinburgh, 3, with whom applications should be lodged by 30th June, 1958. 3903

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointment :—

ASSISTANT SHIFT CHARGE ENGINEER, RYE HOUSE GENERATING STATION.

Salary Class G, Grade 9, £835 × £15 to £880 per annum plus 10% shift allowance.

Applicants should preferably have served an apprenticeship and have obtained a National Certificate in Electrical and/or Mechanical Engineering, or equivalent, and possess experience in the operation of a generating station.

Applications, quoting Reference No. 2/9341, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts, to arrive not later than 28th June, 1958.

W. N. C. CLINCH,
Controller. 3864

CENTRAL ELECTRICITY GENERATING BOARD

Assistant Engineer, Planning Department

ASSISTANT ENGINEER required in the System Planning Branch of the Planning Department at London Headquarters.

Candidates should preferably possess technical qualifications at least equivalent to Graduate Membership of the Institution of Electrical Engineers. Practical experience in the transmission and/or generation sides of the electricity supply industry is essential.

The duties will include assistance with the preparation of generating plant extension programmes, and will be concerned with transmission reinforcements and general matters in connection with the planning and futurue operation of specific areas of the system. Salary within range £1,210-£1,570 p.a.

Applications, stating age,, qualifications, experience, present position and salary, should be forwarded to S. S. Scott, Chief Personnel Officer, 24-30, Holborn, London, E.C.1, by 30th June. Please mark envelopes "Confidential" and quote ref. ER/163. 3874

SIMON HANDLING ENGINEERS LTD.

requires an

ELECTRICAL CONTRACTS ENGINEER

also a

DRAUGHTSMAN

experienced in control gear, wiring diagrams, and cable planning for factory installations. Write stating age, qualifications and experience to

Personnel Department, Ref. RO.38,
Simon Handling Engineers Ltd.
Cheadle Heath, Stockport, Cheshire

3806

***Situations Vacant** (continued)*

WATFORD ELECTRIC & MFG. CO. LTD.
Watford, Herts

offer a progressive opportunity for RESEARCH ENGINEER or PHYSICIST as senior assistant to Director in charge of research and development. The job involves responsibility for applied research in :—

(1) Electromagnetic control devices.
(2) Magnetic and electronic amplifiers.
(3) Automatic control analysis and application.
(4) H.T. and L.T. air break switchgear.

The company has a considerable expansion programme and would welcome applications from graduates versed in scientific investigation in similar fields. Salary commensurate with qualifications.

Applications should be addressed to the Secretary and will be treated with strict confidence. 3881

M.K. ELECTRIC LIMITED
require an
EXPERIENCED SALES REPRESENTATIVE
for
CLYDESIDE & SOUTH-WEST SCOTLAND

THE successful candidate will be required to live in Glasgow. If you have experience in dealing with architects, electrical wholesalers and contractors, are a car owner, and would like to join the sales team of a progressive company marketing products with a world-wide reputation, we would like to hear from you in confidence. Write in the fullest detail to :—

The Sales Manager, M.K. Electric Ltd.
Wakefield Street, London, N.18
3807

A SENIOR POWER ENGINEER

position is open in the Engineering Department of a major oil company based in London, necessitating occasional visits overseas.

Candidates for this post must be under forty years of age and have had several years of experience in the design of thermal power stations both from the steam and power generation sides, and be familiar with the design and layout of the distribution systems required to cover large installations.

A generous salary commensurate with qualifications and experience can be offered. Apply with fullest particulars, age, qualifications, experience, etc., to—Box 3858.

LONDON COUNTY COUNCIL

South-East London Technical College

SEPTEMBER, 1958

LECTURER in Electrical Engineering. Should possess degree, have had suitable industrial experience and ability to teach up to I.E.E. Part III standard.

The College offers full-time diploma, sandwich, part-time day and evening courses in electrical engineering.

Burnham F.E. salary scales, £1,200 × £30 to £1,350 plus additions for training and qualifications; increments within the scale for experience, plus London allowance of either £36 or £48 p.a.

Application forms from Secretary at College, Lewisham Way, London, S.E.4, to be returned by 4th July, 1958. (1167) 3861

COMMERCIAL AND INDUSTRIAL LIGHTING

OLD-established manufacturers require additional sales representative. Applicants must be fully experienced in this field and have established connections. Salary, expenses and commission will be paid on a scale which will enable a competent and experienced man to achieve high earnings. Replies will be treated in confidence.

Please reply to Box 3839.

A SERVICE engineer. A company having extensive service facilities throughout the country have a vacancy for a service engineer to be based in Birmingham and operate in the Midlands area. Applicants should be between 25 and 35 years of age, have experience in the service and installation of light electrical equipment, particularly in the field of control apparatus, preferably temperature control. A clean driving licence is essential. The successful applicant will receive initial training at our Slough factory. Commencing salary up to £14 per week. Apply to—The Rheostatic Company Limited, Cavendish House, Waterloo Street, Birmingham, 2. 3867

A YOUNG man with commercial outlook and sound electrical engineering background is required for interesting work in the sales and design department of an expanding organisation manufacturing selenium metal rectifiers, transformers, and equipment. Previous experience in this field is not essential. Applicants should possess a sound technical education, together with an ability to correspond in good English. Apply—Automat, 366, Moorside Rd., Swinton (Tel. SWInton 4242). 3776

CONTROL gear engineer required, age 23-35, for layout and circuiting of contactor equipment. Good salary. Permanent and progressive position. Canteen, pension scheme. Write stating age, experience and qualifications, if any, to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 273

DESIGNER for prototype work on a wide field of telegraphic and electronic instruments. H.N.C. standard is minimum requirement. Salary commensurate with qualifications and experience. A pension scheme is in operation and the company has its own sports ground. Please write giving full particulars to the Personnel Manager, Muirhead & Co. Ltd., Beckenham, Kent. 3904

DRAUGHTSMAN required at consulting engineers' Glasgow office to assist on layout of 132-kV substations. Prospects of future promotion to engineer. Age 20-28 years. Training for H.N.C. essential. Holiday commitments honoured. Interviews Glasgow or London. Write to Kennedy & Donkin (D.S.H.), 4, Somerset Place, Glasgow, C.3. 3825

DRAUGHTSMAN required for work on medium and large power transformers, voltage rating up to 132 kV. Applicants should preferably have O.N.C. and have served a recognised engineering apprenticeship. Minimum age 27 years. Position is permanent and progressive. Assistance will be given in re-housing. Apply stating experience and salary required to —Denis Ferranti Co. Ltd., Royton, Oldham, Lancs. 3710

DRAUGHTSMEN, electrical, senior and junior, with experience in switchboard and fusegear design required. Write stating full particulars and salary required to—The Artic Fuse & Elec. Mfg. Co. Ltd., Birtley, Co. Durham. 3868

ELECTRICAL contract engineers. Opportunity for two young engineers to join staff of progressive company, one for electrical distribution and allied contracts and one for internal work. Write giving full details, experience and age.—Box 3905.

ELECTRICAL draughtsman required for work on A.C. and D.C. control gear. Must be familiar with all types of circuit diagrams and layout work. First-class working conditions in new modern premises, canteen, pension scheme, five-day week. Apply writing—M.T.E. Control Gear Ltd., Eastwood, Leigh-on-Sea, stating age, experience and present salary. 3884

ELECTRICAL engineer required for sales office, manufacturers West of London. Quotation and scheme preparation for automatic electrical equipment. Age 27-35. Salary £900 with prospects. Write in confidence—Box 3826.

ELECTRICAL or mechanical engineer wanted by large German company for German-English translations. Applications are invited from British trained engineers with a good knowledge of German, who have an inclination towards translation work, and desire to work in a pleasant environment in Germany for at least 2 to 3 years. Write stating age, education, experience and salary to—Box 373.

ELECTRO-mechanical draughtsmen required for production drawing office of company engaged in the manufacture of control gear equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middx. 275

ELECTRICAL/mechanical sales engineer required for service in British West Africa with important British company engaged on sales and service of a range of electrical and mechanical equipment comprising cable, switchgear, oil engines, pumps, compressors, etc. Successful candidate will be responsible for sales, servicing and installation. Applicants must have technical qualifications and some commercial experience an advantage. Duties will involve contacts senior Government officials, consultants, architects, contractors, etc. Salary commensurate with age, qualifications and experience. First-class passage sea/air, free furnished quarters, full pay on leave after approximately 18-month tours, pension scheme. Reply by letter stating age, domestic status and full particulars qualifications and experience, quoting ref. E.M., to—Box 3885.

FOREMAN and C.H. electricians required. Permanent type installations and maintenance of electrical plant on civil engineering contracts. Armoured cable, conduit, P.V.C., etc. Write stating age, experience, etc., to—Box 3779

GRANADA Group require a senior engineer. He will be responsible for installation and maintenance of all electrical equipment and heating and ventilating plant in theatres, restaurants, shops and other buildings. Preference given to the chartered engineer with sound practical experience and able to prepare schemes for new installations. Superannuation scheme. Write details of age, experience and salary required to — Cecil G. Bernstein, Managing Director, Granada Group Ltd., 36, Golden Square, London, W.1. 3869

JUNIOR estimating and contracts engineer required for expanding switchgear company. Must have H.N.C. or equivalent. Previous experience in preparation of composite tenders for electrical switchgear essential. Apply giving age, salary required and full details of experience to date to — Reference AWB, Switchgear & Equipment Ltd., Banbury, Oxon. 3738

LIGHTING sales representatives required for London area. Only salesmen experienced in selling to industrial and commercial users with proved sales records may apply. Salary and commission. Car provided or contribution made to car owners. Apply to Secretary, Ensel Electric Co. Ltd., 3, Eden Grove, Holloway Rd., London, N.7 (Tel. No. NORth 5866). 3870

MACHINE designer required by well-known firm for development post. Experience in design of motors essential, also alternators and D.C. an advantage. Interesting position offering good prospects at a salary commensurate with age, experience and qualifications.—Box 3847.

PRODUCT design draughtsmen required for light engineering products. 5-day week. Pension schemes. Reply, giving full particulars of experience, age and salary required, to—Labour Manager, Parnall (Yate) Limited, Yate, Nr. Bristol. 3692

REPRESENTATIVE required by Northern manufacturers for London area. Good connection electrical domestic appliance trade. Salary, commission. Own car.—Box 3906.

SENIOR draughtsmen required, experience in the design of automatic electric control and/or switchgear essential, preferably also familiar with British Admiralty and marine requirements. Rates above A.E.S.D. according to experience; good conditions; varied and interesting work. Apply in confidence to—Electro Dynamic Construction Co. Ltd., Control Gear Division, Bristol Road, Bridgwater, Somerset. 3702

STOREKEEPER required to take charge of wholesale electrical warehouse, South London. Must have had experience with electrical wholesaler. Write in confidence.—Box 9395.

SURVEYORS and assistant surveyors required for work at home and overseas having some experience in the survey and profiling of routes for overhead transmission lines. Pension fund. Apply in writing to Staff Officer, British Insulated Callender's Construction Company Ltd., 30, Leicester Square, London, W.C.2, quoting reference C/83/55. 3886

TECHNICAL assistant to electrical engineer required for development and production work in connection with the manufacture of dental and medical equipment. O.N.C., drawing office and workshop experience desirable. Pension scheme. Canteen facilities. Apply in writing to—Personnel Dept., A.D.E.I. Ltd., Churchfield Road, Walton-on-Thames. 3842

SENIOR transformer draughtsman with experience of distribution transformers up to 1,000 kVA. Permanent and progressive position. London area.—Box 3763.

TELECOMMUNICATIONS sales engineers. Delegate sales engineers reqd. for important overseas appointments. Essential qualifications are wide telecommunications experience especially in telephone switching field, a knowledge of systems in use throughout the world, negotiating ability, and aptitude for foreign languages. Education to B.Sc. standard with A.M.I.E.E. and specialised C. and G. Certificates. Age range 30 to 35. Physical fitness essential. Generous salaries and overseas allowances. Local leave and periodic passage-paid home leave for engineers and family. Company pension scheme. Suitable commercial training will be given before posting overseas. Written applications, with small recent photograph, should be made in confidence stating age, education, experience and present salary, to—Staff Officer, Ref. 744/15, Siemens Edison Swan Ltd., Woolwich, London, S.E.18. 3766

YOUNG & WILDSMITH Limited, 35, Little Russell St., London, W.C.1, require senior and junior representatives to operate in the London area and from their branches. Must have actual electrical wholesale experience and connection with contractors and users. Brief particulars only, treated in strict confidence.— 3848

£1,000 a year plus bonus, pension scheme and excellent prospects of promotion offered to an electrical engineer who can develop sales of motors and generators up to 1,000 h.p. in London area. Apply giving age, education, training and experience to—Box 3843.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

B.Sc., A.M.I.E.E., 38, works engineering background, at present manager (commercial and technical) of overseas engineering company, invites proposals. Available interview U.K. now. Brief details please.—Box 9391.

ELEC. construction engineer seeks overseas contract. Extensive overseas history. Any field.—Box 9397.

ELECTRICAL supervisor (M.A.S.E.E.) requires situation with responsibility in the Tees-Tyne area. All offers seriously considered.—Box 9393.

ELECTRICIAN seeks overseas work. Experience on number of contracts abroad.—Box 9379.

ENGINEER, age 33, seeks position as outside representative, ten years' design experience, transformers up to 100 kVA, rectifier, and fluorescent ballast units. H.N.C. C. & G. Tech. Elect. I and II.—Box 9384.

SALES eng. requires position on North-East coast. Excellent connection with industry and shipbuilding in this area.—Box 9394.

ARTICLES FOR SALE

NEW OXFORD TRANSFORMER WELDERS

For Immediate Delivery

160/450 amp. sizes, oil cooled pattern for operation on 400/440 v. single phase, or 200/240 v., dual welding voltage 50/80; in-built coarse and fine regulators.

Prices as follows: 450 amp. £135.
350 amp. £99 10s.
250 amp. £71.
180 amp. £45.

GEORGE COHEN SONS & CO. LTD.
Wood Lane, London, W.12
(Tel. Shepherds Bush 2070) and
Stanningley, Nr. Leeds
(Tel. Pudsey 2241) 3850

ELECTRIC HOUSE SERVICE METERS

PREPAYMENT and credit, 200/250 v. A.C., s/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.

ALBERICE METER COMPANY
Fairfax Works, Fairfax Rd., London, N.8
(Tel. MOUntview 7944, 6373) 191

VARIABLE SPEED MOTORS

400/440 volts, 3-phase

270-h.p., B.T.H., Schrage type, 370/95 r.p.m.
0/225 h.p., HARLAND, Ward Leonard type, 0/1,750 r.p.m.
170/27.5 h.p., B.T.H., Schrage type, 1,000/400 r.p.m.
0/150 h.p., MATHER & PLATT, Ward Leonard type, 0/460 r.p.m.
0/100 h.p., W. H. ALLEN, Ward Leonard type, 0/1,250 r.p.m.
35 h.p., L.D.C., Ward Leonard type, 300/1,350 r.p.m.

GEORGE COHEN SONS & CO. LTD.
Wood Lane, London, W.12
(Tel. Shepherds Bush 2070) and
Stanningley, Nr. Leeds
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ELECTRIC MOTORS FOR SALE

FOUR 90-h.p. BRUSH slipring Motors, 400/440-3-50-1,460 r.p.m. with o.i. starters.
45-h.p. BROOK S.C. Motor, 440-3-50-410 r.p.m. with o.i. Star Delta starter.
Five 200-h.p. E.C.C. 500-volt D.C. Motors, 425 r.p.m. with BROOKHIRST panels.
120-h.p. MET-VICK. 500-volt D.C. Motor, 500/700 r.p.m. with starter.
45-h.p. MET-VICK. 500-volt D.C. variable speed Motor, 500/1,000 r.p.m. with starter.

REED BROTHERS (ENGINEERING) LTD.
Replant Works
Woolwich Industrial Estate
London, S.E.18
(Telephone: Woolwich 7611/6) 3907

LARGE A.C. MOTORS

3-phase, 50 cycles

Maker.	H.P.	Volts.	R.P.M.
B.T.H.	1820	3.3 kV	368
B.T.H.	1800	400/440	368
MATHER & P.	350	400/440	720
METRO-VICK.	310	400/440	1440
MATHER & P.	300	400/440	720
BRUSH	250	400/440	420
B.T.H.	250	400/440	480
MATHER & P.	200	400/440	960
BROOK	110	400/440	580
BROOK	110	400/440	960
CROM. PARK.	100	400/440	480

THOS. W. WARD LIMITED
Albion Works, Sheffield
Phone 26311 (ex. 347); Grams, Forward. 321

SPOT WELDERS

FIVE 25-kVA air-operated spot welders by SCIAKY, 415/1/50, single or repeat spotting, 14 in. reach, with cold cathode timers. Several 15-kVA units also available. All for prompt delivery.

GEORGE COHEN SONS & CO. LTD.
Wood Lane, London, W.12
(Tel. Shepherds Bush 2070) and
Stanningley, Nr. Leeds
(Tel. Pudsey 2241) 3851

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd., London W.4. 57

BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 50/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

ALTERNATORS from ½ to 675kVA in stock, single and three-phase, all voltages and frequencies. Guaranteed. Many unused. Send your requirements.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, generators, 1-100 kVA, all voltages. Specialists—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 147

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 140/-. See Quarterly.—Tradex, Surbiton. 170

B.T.H. motor alternating set on combination bedplate, comprising 6.6-kV driving motor, 710 h.p., 750 r.p.m., with exciter, direct coupled to single-phase alternator, 25 cycles, 120 volts, 4,000 amps. May be seen running at Universal Grinding Wheel Co. Ltd., Stafford. 3637

CABLE for sale. A quantity of surplus high and low voltage and multicore cables. For full particulars and form of tender apply—Supplies and Stores Officer, Central Electricity Generating Board, South Eastern Division, Lower Ham Road, Kingston-on-Thames (Tel. KIN. 7788, Ex. 10). 3856

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (EALing 3155/6). 117

CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS and motor-alternators, 24, 110 and 220v. D.C. to 230/1/50 A.C., 125 watts to 6 kVA in stock.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

COPPER braided tubular ¼" tape, about 700 yds., new condition, 1s. 8d. per yard.—Thermega Ltd., Ermyn Way, Leatherhead, Surrey. 3798

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—F. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

ELECTRICAL equipment for sale: British Electric Transformer, 200 kVA, 6,000-400v., 50 cycles, 3-phase; James Tate 150-kVA, 6,000-v. H.T. switchgear, complete with meters. No reasonable offers refused. Offers to—Chisholm & Co. Ltd., Sefton Works, Field Lane, Litherland, Liverpool. 3704

ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

FLAMEPROOF switchgear, lighting fittings, conduit fittings, motors, etc., always in stock.—Leighton Warehouse Co., 6, Church Road, Linslade, Leighton Buzzard, Beds. (Tel. No. L.B. 3400). 9341

FREQUENCY changers and variable frequency M/A sets in stock, and to specification.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 148

Articles for Sale (continued)

FLUORESCENT fittings, lamps, starters and control gear for home and export. Fully guaranteed by actual manufacturers. Send for catalogues. — The Anglo-American Electrical Company, Olive Street, Bury, Lancs. 245

FLUORESCENT tubes reconditioned and guaranteed as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks.—The Anglo-American Electrical Company, Bury New Road, Breightmet, Bolton, Lancs. (Telephone, Bolton 7251). 212

FRACTIONAL h.p. motors, new, ex stock A.C./D.C., Universal, B.T.H., Delco-Remy, G.E.C., Fracmo, Newman, Scophony. — Jeary Electrical Co. Ltd., 5, Lamb's Buildings, London, E.C.1. 126

GENERATING plants of all types, new and reconditioned up to 100 kVA in stock. Special plants built to order at short notice; automatic mains failure, etc. — Powerco Ltd., 312, York Rd., London S.W.18 (VAN. 5234). 151

GENERATING sets for sale, petrol, diesel and steam, from 1 kW up to 700 kW, A.C. and D.C. switchboards.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 163

HACKBRIDGE & Hewittic rectifier set complete; input 400 v., 3-ph., 50 c., output 200 v., 20 kW. Bargain £250 o.n.o.—A. C. Dibley & Co. Ltd., 72, Granville Road, London, N.W.2. 3871

HIGH frequency alternators and converters, 400 to 2,600 cycles up to 6 kVA in stock. Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 149

HOUSE service meters, C. & H., Aron, E.A.C., 20-240 v. A.C., s.-ph., 50 c., 5 amps., 17s. 6d.; 1s. 6d. postage—Universal Electrical, 217-221, City Rd., London, E.C.1. 37

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock. — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTOR generators of all types in stock and to specification up to approx. 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 152

MOTORS, starters, circuit breakers. Huge stocks of all types, ½ to 300 h.p. Stock list or quote by return.—J. S. Ramsbottom & Co. Ltd., Bow St., Keighley (3774-5-6). 70

NAMEPLATES, engraving, diesinking, stencils. — Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

NEW electric motors for disposal. All 400/440/3/50, protected and totally enclosed. We are offering these at considerably reduced prices.—Carter & Co., Nelson, Lancs. 9385

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading. — Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. or D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

PREPAYMENT 1s. slot house service meters. —Universal Electrical, 217-221, City Road, London, E.C.1. 36

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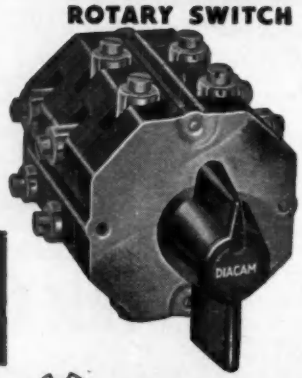

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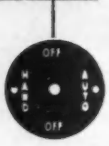

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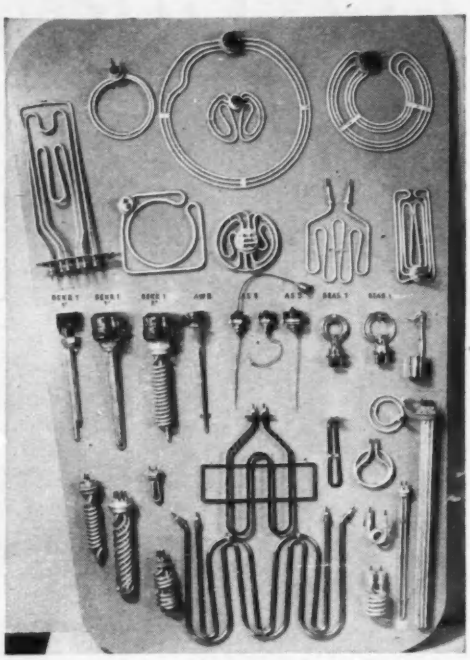

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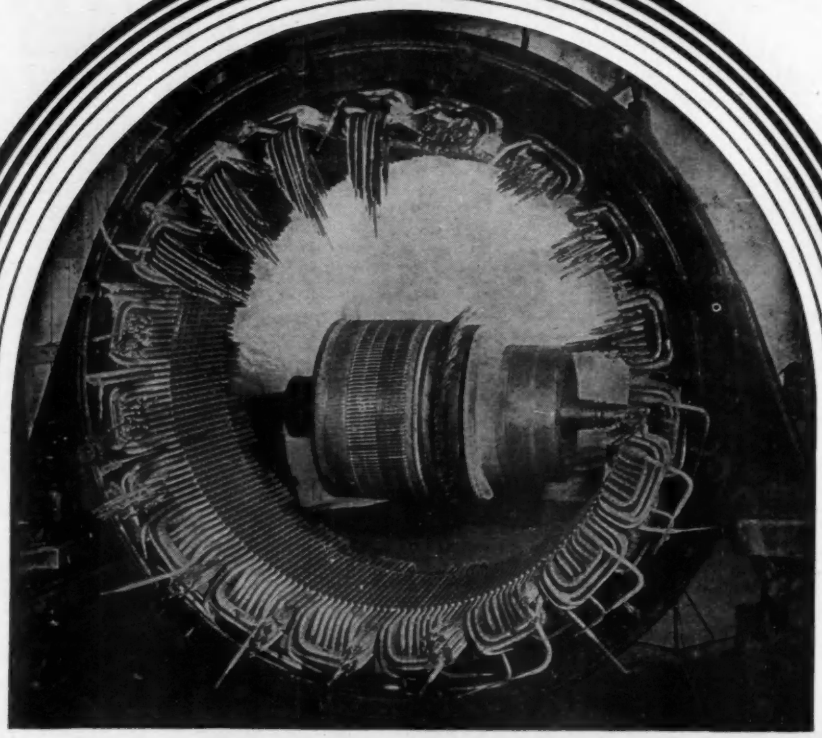

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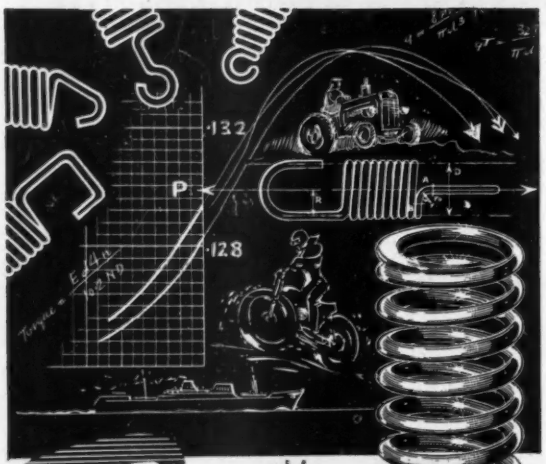

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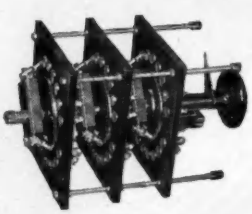

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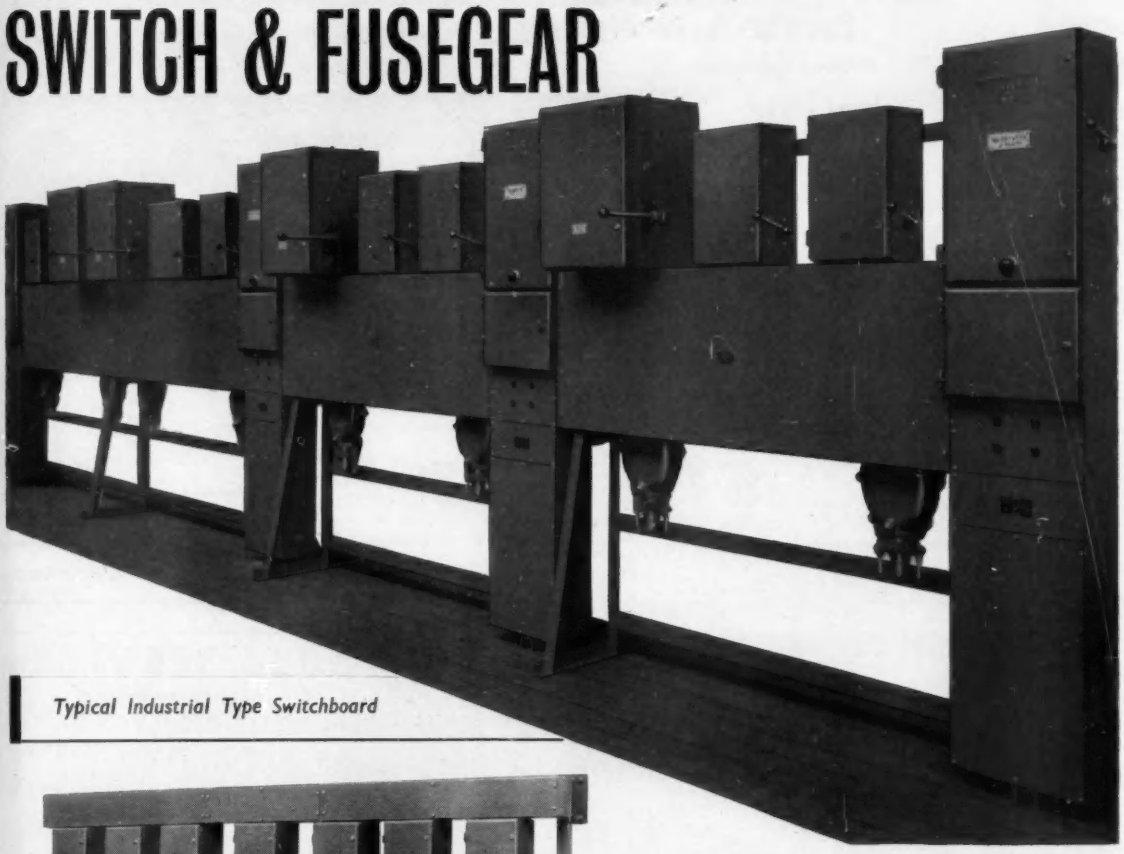

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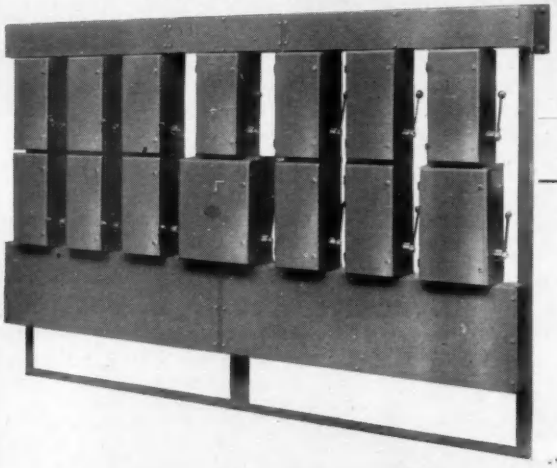

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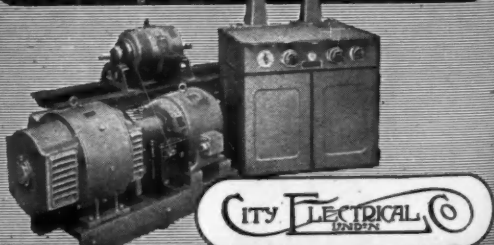

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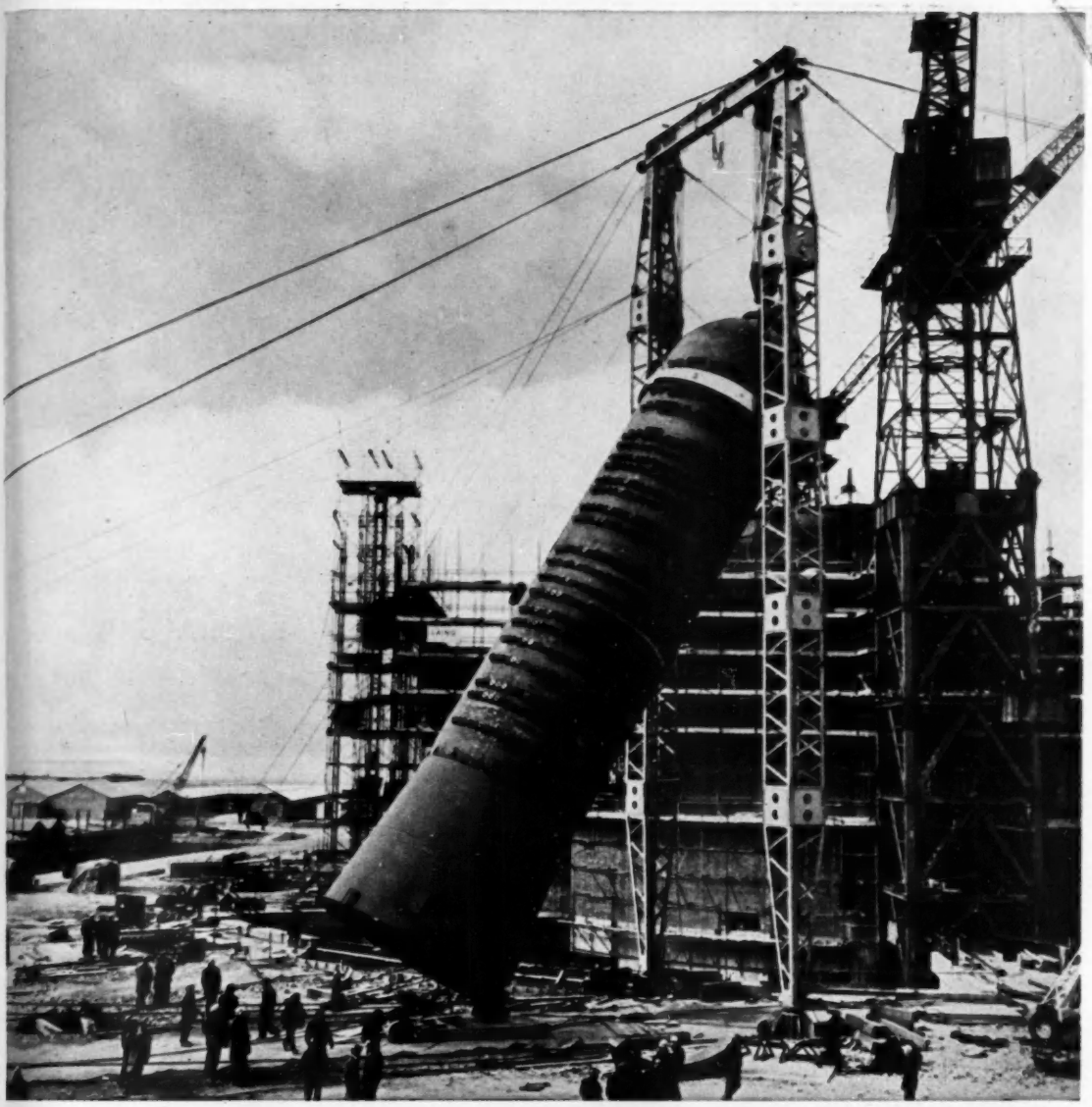
Published by ELECTRICAL REVIEW PUBLICATIONS LTD., at Dorset House, Stamford Street, London S.E.1 and printed in Great Britain at THE CHAPEL RIVER PRESS, Andover Hants.



3rd April, 1958. C.E.G.B. Berkeley Nuclear Power Station, being built by A.E.I.-John Thompson Nuclear Energy Company Ltd.

HEAT EXCHANGERS, BERKELEY

On Thursday, 3rd April, the first of the sixteen large heat exchanger (or 'boiler') vessels for Berkeley Nuclear Power Station was erected on site by John Thompson.

The vessel, 70 ft. long, 17 ft. 6 in. in diameter and weighing 133 tons, was transported over a distance of some 300 yards on two bogies from the Berkeley site boiler shop, where its fabrication was completed, to its position adjoining No. 1 reactor house.

Since that date, the second heat exchanger vessel has also been erected and others are following in sequence.

Manufacture and installation of these heat-exchanger vessels by John Thompson is so arranged as to eliminate the transportation of excessive loads from the works at Wolverhampton and yet to reduce to a minimum the amount of work to be done on site. This is achieved by manufacture of the vessel in sections at the home works and then welding-up sections to form complete vessels in a site boilershop specially erected at Berkeley. The site boilershop accommodates four vessels at a time.

JOHN THOMPSON GROUP

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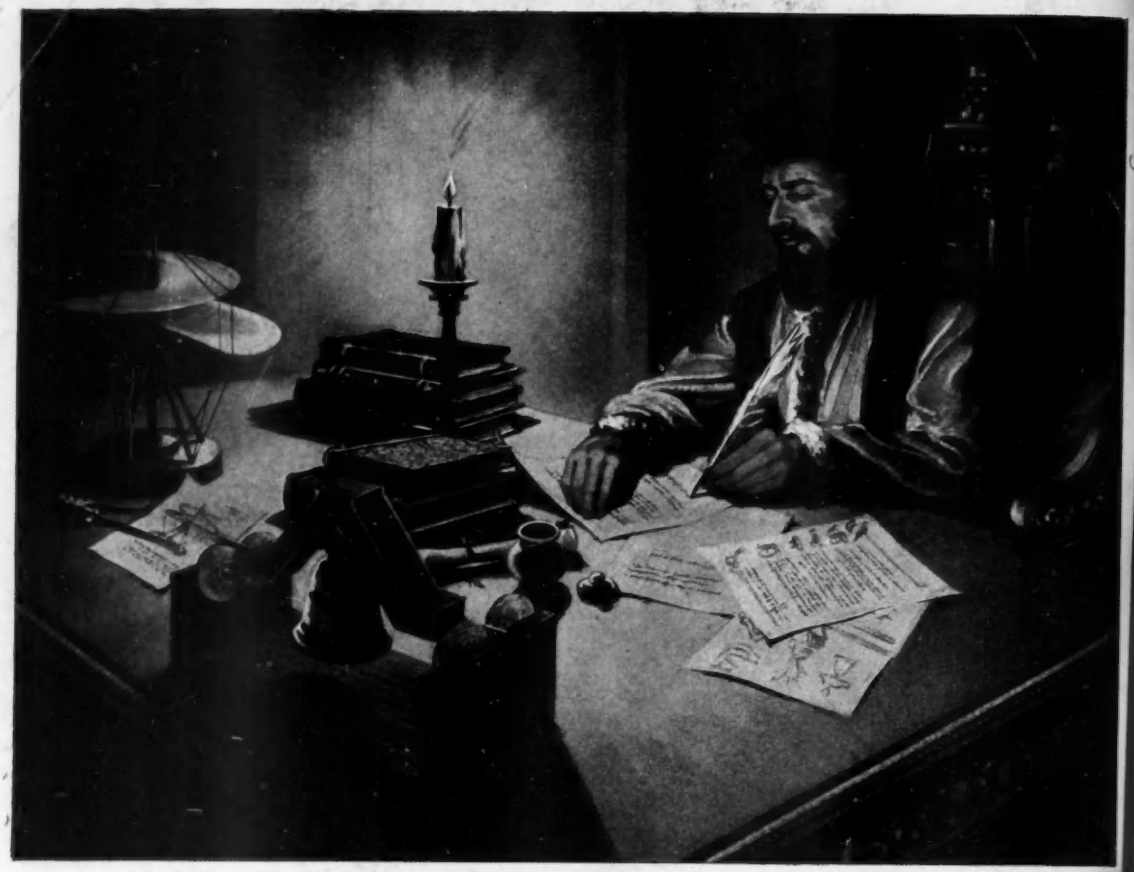

The Conquest of Friction

Leonardo da Vinci, that versatile genius of the Renaissance, studied friction in many of its aspects, being the first to distinguish between sliding and rolling friction. He also remarked upon the importance of polishing the surface of parts that move in a groove or around a pivot. Among his many manuscripts are sketches of several ingenious anti-friction bearings which he described as 'pivots of the highest perfection' and mechanisms whose motion, once started, were declared to be 'wonderful and supernatural in duration'. Some of these are known to have had practical application. Hundreds of years later many more of da Vinci's theories were to find practical expression and further development with the foundation of SKF and the introduction of a unique range of anti-friction bearings for many different purposes.

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